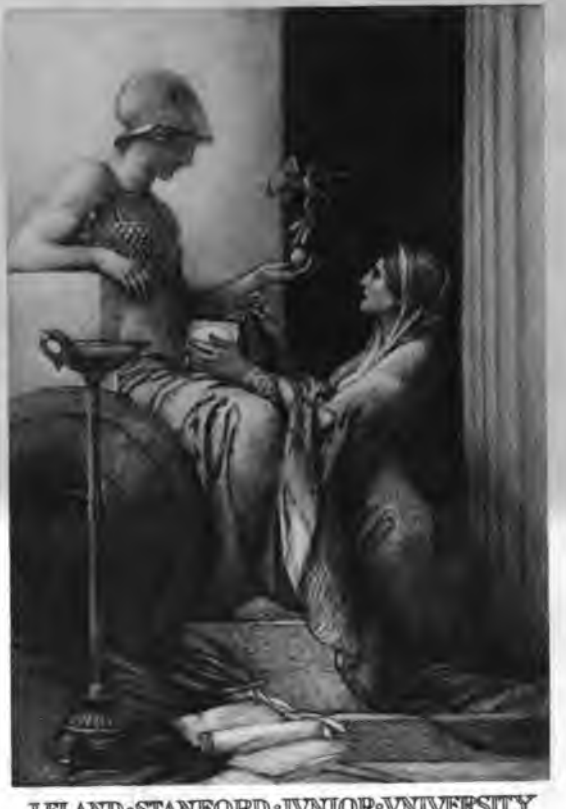
W. S. Bayley

A summary of progress in
mineralogy and petrography in 1887.

Madison, 1888.



No. 6

A

SUMMARY OF PROGRESS

IN

Mineralogy and Petrography,

IN

1887

BY

W. S. BAYLEY, Ph. D.

FROM MONTHLY NOTES IN THE "AMERICAN NATURALIST."

MADISON:
1888.

(EXTRACTED FROM THE AMERICAN NATURALIST, JANUARY, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Mr. G. A. J. Cole[2] has recently attempted to explain the occurrence in rocks of "hollow spherulites" like the lithophysen of Von Richthofen. The principal theories proposed to account for these bodies are discussed, and that one is accepted which regards them as the result of the alteration of spherulites, in preference to the one in which a vesicular origin is assigned them. The present writer thinks that a study of the phenomena attending the alteration of spherulites will explain satisfactorily the occurrence of the hollow spherulites. In many of these there is often found a little patch of felsitic material with a radial structure, and from this Mr. Cole argues that the whole body was once of the same nature, and that the greater part of the original filling has been removed by decomposing agents, probably through the channels afforded by perlitic cracks. He then examines[3] many of the spherulitic rocks of Great Britain and some from localities in Europe and America, and finds that his views are on the whole confirmed.——Professor Milne, in a recent number of the Transactions of the Seismological Society of Japan,[4] states that the lavas of the Japanese volcanoes (one hundred in all, of which forty-eight are still active) are chiefly andesites, the hornblende varieties of which frequently contain quartz. Those containing olivine approximate to basalts, though true basalt is rare. A critical study of these rocks is now being made by members of the Japanese Survey.——A microscopical examination[5] of the volcanic ash ejected during the recent eruption in New Zealand shows it to contain fragments of limpid plagioclase crystals, dark green pleochroic hornblende, sometimes fibrous, and extinguishing at 15°, biotite and a "golden-colored mica" in well-formed crystals of hexagonal outline, pyrite, magnetite, broken pieces of sulphur, and glass containing crystallites arranged in flow-lines.——By treatment of the granite-porphyry from Beucha with hydrofluoric acid, and then the residue thus obtained successively with various other acids, Kroustshoff[6] has succeeded in isolating from it small colorless isotropic crystals with glassy inclusions. These crystals possess a specific gravity greater than 3, a refractive index equal to that of garnet or spinel, and show, before the spectroscope, the lines of iron, calcium, magnesium, and aluminium. The author calls attention to the similarity between these crystals and those which he obtained in a like manner from the phonolite[7] of Olbrück, and

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] Quart. Jour. Geol. Soc., xli., No. 162, May, 1885, p. 162.
[3] Ib., xlii., No. 166, May, 1886, p. 183.
[4] Vol. x. part 2, Abst. Nature, Nov. 4, 1886, p. 19.
[5] J. Joly, Nature, Oct. 21, 1886, p. 595.
[6] Note sur un nouveau minéral accessoire de la roche de Beucha (près de Leipzig). Bull. de la Soc. Franç. de Minéralogie, ix., No. 4, 1886; also Neues Jahrb. für Min., etc., 1886, ii. p. 180.
[7] Ib., ix., No. 3.

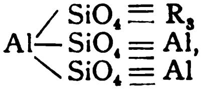
which he believes are members of the spinel group. A mineral very like those above mentioned also occurs in the tonalite from Adamello. The same author, in another paper, describes a peridotite[1] from Goose Bay, in the Straits of Magellan. It consists essentially of olivine and enstatite, with picotite and apatite as accessory minerals, and serpentine, chrysolite, bastite, and magnetite as secondary constituents. The olivine contains gas, liquid and glass inclusions. The fibres of the bastite seem to have been curved by some mechanical agency (pressure). An analysis of a comparatively fresh specimen yielded,—

SiO_2	Al_2O_3	Fe_2O_3	Cr_2O_3	Fe(Mn)O	MgO	CaO	H_2O
43.39	2.26	0.35	0.28	10.47	39.89	2.33	1.54

——Basalts, pyroxene-andesites, hornblende-pyroxene-andesites, hornblende-mica-andesites, and dacites, very like similar rocks occurring in the western portion of our own country, are described by Messrs. Hague and Iddings[2] from the Republic of Salvador, Central America.——Certain "Pliocene sandstones" from Montana and Idaho, according to Mr. G. P. Merrill,[3] consist of pumiceous dust cemented by calcite or clayey material. An analysis of one of these from Little Sage Creek, Montana, yielded Mr. Whitfield,—

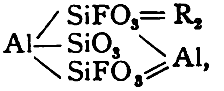
SiO_2	$Fe_2O_3 + Al_2O_3$	CaO	MgO	Na_2O	K_2O	H_2O	loss by ignition
65.56	18.24	2.58	0.72	2.08	3.94	1.12	6.50

Mineralogical News.—The lithia micas of Maine and the iron-lithia micas of Cape Ann, Mass., have been subjected to a very thorough chemical examination by Prof. F. W. Clarke and the gentlemen associated with him in the chemical department of the U. S. Geological Survey. The various types of these minerals, from different localities in the States named, have been analyzed, and the results of these analyses are given in a paper in the *American Journal of Science.*[4] By supposing fluorine to replace the hydroxyl (HO) group in ortho-silicic acid, a series of fluo-silicic acids may be obtained as a nucleus upon which to build the formulæ representing the composition of the various lithia micas. For example, if we represent muscovite by



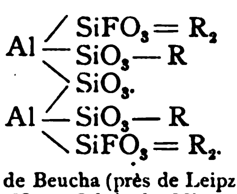
$$Al\begin{cases} SiO_4 \equiv R_3 \\ SiO_4 \equiv Al \\ SiO_4 \equiv Al \end{cases}$$

then lepidolite might be represented by



$$Al\begin{cases} SiFO_3 = R_2 \\ SiO_3 \\ SiFO_3 \end{cases}\!\!\!\!>Al,$$

and cryophyllite by



$$\begin{array}{l} Al\begin{cases} SiFO_3 = R_2 \\ SiO_3 - R \end{cases} \\ \quad > SiO_3. \\ Al\begin{cases} SiO_3 - R \\ SiFO_3 = R_2. \end{cases} \end{array}$$

---

[1] Note sur un nouveau minéral accessoire de la roche de Beucha (près de Leipzig). Bull. de la Soc. Franç. de Minéralogie, ix., No. 1; also Neues Jahrb. für Min., etc., 1886, ii. p. 180.

[2] Amer. Jour. Sci., xxxii., July, 1886, p. 26.

[3] Ib., Sept. 1886, p. 199.

[4] November, 1886, p. 353.

——Messrs. Penfield and Harper[1] have carefully analyzed pure *ralstonite* from Greenland, and have found it to contain,—

Mg	Na	K	Ca	Al	F	H_2O	total
4.46	4.27	0 12	0.03	24.25	39.96	18.73	91.70

Upon calculation it was found that the amount of fluorine obtained in the analysis was not sufficient to unite with all the metals; hence these authors assume that the metals which are in excess of the fluorine combine with hydroxyl. If this be true, the composition of ralstonite as calculated from the analysis is as follows:

Mg	Na	K	Ca	Al	F	OH	OH_2
4.39	4.27	0.12	0.03	24.45	39.91	16.27	10.12=99.36.

and the mineral may be regarded as an isomorphous mixture of $(MgNa_2)Al_3F_{11}.2H_2O$ and $(MgNa_2)Al_3\ (OH)_{11}$.——The mineral which best illustrates the power of fluorine to replace hydroxyl in a chemical compound is *herderite*, which has recently been shown[2] by these same investigators to consist of an isomorphous mixture of $CaBeFPO_4$ and $CaBe(OH)PO_4$.——*Lucasite*, a new variety of vermiculite, from Corundum Hill, Macon County, N. C., is described by Mr. T. F. Chatard[3] as a foliated mineral of a yellow-brown color, with eminent basal cleavage and a submetallic, greasy lustre. It dissolves in hydrochloric acid and exfoliates when heated, swelling at the same time to twice its original volume. It is biaxial and negative, with a small optical angle.——The well-known garnet pseudomorphs from the Lake Superior region have been examined by Messrs. Penfield and Sperry.[4] According to these gentlemen the alteration of the garnet consists in a slight oxidation of its iron, a decrease of its silica, an almost total disappearance of its manganese and calcium, and an increase in its magnesium, alkalies, and water. The resulting mineral is a ferrous chlorite[5] with a composition approaching that of prochlorite. An examination of a decomposed garnet from Salida, Colorado, yielded the same result.——Some very fine pseudomorphs of limonite after pyrite are figured by T. G. Meem[6] in the October number of the *American Journal of Science*, in which the striations due to the oscillation of the octahedron and icositetrahedron are well preserved.

Meteorites.—During the past summer quite a number of short articles descriptive of meteorites have appeared in the *American Journal of Science*. In the June number Mr. W. E. Hidden[7] describes two masses, neither of which was seen to fall. One is a meteoric iron, found in Independence County, Ark. It weighs ninety-four pounds. A curious feature in connection with it

[1] Amer. Jour. Sci., Nov. 1886, p. 380.
[2] Penfield and Harper, Amer. Jour. Sci., xxxii., Aug. 1886, p. 107.
[3] Amer. Jour. Sci., xxxii., Nov. 1886, p. 375. [4] Ib., Oct. 1886, p. 307.
[5] *Cf.* American Naturalist, Feb. 1886, p. 161.
[6] Amer. Jour. Sci., xxxii., p. 274. [7] Ib., xxxi., No. 186, p. 460.

is the existence through it of a hole measuring five-eighths of an inch in diameter at its narrowest part. Its composition is Fe = 91.22; P = 0.16; Co and Ni = 8.62; thus belonging to the class holosiderite of Brezina. The second mass is from Laurens County, S. C. Its composition, as determined by Mr. J. B. Mackintosh, is as follows: Fe = 85.33; Ni = 13.34; Co = 0.87; P = 0.16. The Widmanstättian lines indicate a regular crystallization. The presence of occluded hydrogen and little masses of ferrous chloride (lawrenceite) in its mass render this meteorite exceedingly interesting. In the October number the same author [1] describes a meteor found at Fort Duncan, Maverick County, Texas. It weighs ninety-seven and a quarter pounds, and contains 94.90 per cent. Fe; P = 0.23; Ni and Co = 4.87. Sp. gr. = 7.522. Its peculiarity is the development in it of two series of very fine lines crossing each other at an angle of 70°.——Since the publication of the article [2] on the three masses of meteoric iron from Glorieta Mountain, New Mexico, four other pieces of the same meteorite have been found. An analysis by Mr. Eakins, of the United States Geological Survey, of what is supposed by Mr. Kunz [3] to be the seventh piece of this meteorite, yielded,—

Fe	Ni	Co	Cu	Zn	Cr & Mn	C	P	S	Si
88.76	9.86	0.51	0.03	0.03	traces	0.41	0.18	0.01	0.04

——The crystalline structure of meteoric irons has been well worked out by O. W. Huntington,[4] who examined the collection of these bodies belonging to Harvard College. By a very careful investigation of the appearance of the Widmanstättian figures on cleavage faces of the different specimens, and by comparison of similar appearances in the case of many minerals, which, during their crystallization, extruded various impurities (as, for instance, many micas containing magnetite), Mr. Huntington is led to conclude that (I.) many meteoric irons show cleavages parallel to the principal planes of symmetry in the isometric system; (II.) that the Widmanstättian figures and Neumann lines are sections of planes of crystalline growth parallel to the three planes mentioned; and (III.) that the features of the Widmanstättian figures are due to the elimination of incompatible material during the process of crystallization. The results of the investigation strengthen the belief that meteoric irons were thrown off from the sun or one of the fixed stars, and that they have cooled very slowly, while revolving in a zone of intense heat.——A meteoric stone found in Utah, between Salt Lake City and Echo, according to Messrs. E. S. Dana and S. L. Penfield,[5] appears under the microscope to consist of spherules of olivine, some of which have a distinct coarsely fibrous structure in consequence of the inclu-

[1] Amer. Jour. Sci., Oct. 1886, p. 304.
[2] G. F. Kunz, ib., III. xxx. p. 235; *cf.* American Naturalist, Dec. 1885, p. 1214.
[3] Ib., xxxii., Oct. 1886, p. 311. [4] Ib., III., xxxii., Oct. 1886, p. 284.
[5] Amer. Jour. Sci., xxxii., Sept. 1886, p. 226.

sion of dark-colored glass, bronzite in broken fragments and also in spherules with a fine fibrous structure, broken plagioclase, rich in black inclusions lying parallel to the twining planes, and, finally, patches of an isotropic mineral, probably maskelynite. It contains the following constituents: nickeliferous iron, 17.16 per cent.; mineral portion, 82.84 per cent. The iron yielded upon analysis, Fe = 91.32 per cent.; Ni = 8.04; Co = 0.60; Cu = 0.04. The mineral portion was divided into two parts, one soluble in hydrochloric acid yielded, FeS = 6.08; NiS = 0.62; and 48.85 per cent. silicates; the other, insoluble in this acid, gave, chromite 0.75, and 43.22 per cent. silicates. A second meteorite, from Cape Girardeau, Missouri, proved, upon examination, to belong to the same general class as the one last mentioned.——A catalogue of the meteoric stones in the collection of Yale College, one hundred and forty-seven in number, is published as an appendix in the same number of this journal. ——Perhaps the most important paper on meteorites which has appeared during the year is that of Reusch.[1] In this are described four Scandinavian meteorites, each of which presents interesting features. The most noteworthy of these is the occurrence of olivine in forms imitative of organic structures, and also, together with bronzite, forming spherulitic bodies in a ground-mass composed of crystals of bronzite, augite, and iron in a glassy base. The most instructive fact in this connection is the discovery of a brecciated structure in two of the meteors described. The rounder grains which occur in the crystalline ground-mass surrounding them are of the same nature as this ground-mass, and are in turn composed of other smaller grains of similar mineralogical composition. A gradual transition from the large fragmental particles to the "chondra" was traced, and from this fact, in connection with the others above mentioned, the author draws certain general conclusions in regard to the origin of meteoric bodies, which, although exceedingly interesting, it would be impossible to incorporate in these notes in any logical sequence.

Crystallographic News.—Quite a number of new measurements of crystals have recently been made by Prof. E. S. Dana.

GOLD[2] from the White Bull Mine in Oregon possesses the form 3O3. The crystals are distorted so as to assume a rhombohedral symmetry. Crystals of gold from California showed a persistence of the hexakisoctahedron $18O\frac{9}{5}$.

THE BROOKITES[3] from Magnet Cove are divided for the sake of convenience into those of prismatic habit and those in which the pyramid is the predominating form. Twenty-five figures of typical crystals are pictured.

[1] Neues Jahrb. f. Min., etc., Beil., Bd. iv., 1886, p. 473.
[2] Amer. Jour. Sci., xxxii., Aug. 1886, p. 132.
[3] Ib., xxxii., Oct. 1886, p. 314.

COLUMBITE.[1]—A number of new crystals of this mineral from Standish, Maine, have been measured, and from the data thus obtained a recalculation of the axil ratio has been made. According to the new measurements, a : b : c = .40234 : 1 : .35798 (Schrauf's position) and .8285 : 1 : .88976 (Dana's position). The species is without doubt orthorhombic. Differences in composition appear to have little effect on the value of interfacial angles.

DIASPORE.[1]—The two new planes $P\check{\frac{4}{3}}$ and $P\check{2}$ were discovered on a fine crystal of diaspore from Chester, Mass.

SULPHUR.[1]—$\frac{1}{4}P$ and $\frac{3}{5}P_{\bar{3}}$ are described as new forms on sulphur from Rabbit Hollow, Nev.

——Among some remarkably fine crystals of *hiddenite*, *xenotime*, *monazite*, and *quartz* from North Carolina, Mr. Hidden[2]. mentions having found on the latter a well-developed basal plane which yielded to Professor Des Cloizeaux, OP $\wedge$ R = 128°, the calculated angle being 128° 13′. On black *tourmaline* from Sharpe's township, Alexander County, the new form $\frac{3}{5}R$ was detected. On *xenotime* from the same county 3P was found, and on *herderite* from Stoneham, Maine, the new plane $P_{\overline{\infty}}$. A twinned crystal of *molybdenite* from Renfrew, Canada, suggests that this mineral may crystallize in the hexagonal system with its planes hemimorphically developed.

[1] Amer. Jour. Sci., xxxii., Nov. 1886, p. 386.
[2] Ib., xxxii., Sept. 1886, p. 204.

(EXTRACTED FROM THE AMERICAN NATURALIST, APRIL, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The rocks occurring in equatorial Eastern Africa (Massai-Land) have been found by O. Mügge[2] to embrace granophyres, gneisses, mica schists, and amphibolites among the older rocks, and liparites, trachytes, nephelinites, nepheline-tephrites and basanites, limburgites, melilite-basalts, augite andesites and feldspathic basalts among the younger ones. The granophyres contain an augite with partings parallel to $\infty P\bar{\infty}$ and oP, hypersthene and hornblende, all of which are so closely and peculiarly associated that the author thinks they might be due to the solution in the granophyre substance of some foreign inclusion. The gneisses, schists, and amphibolites also contain a diallagic and an orthorhombic augite. Among the granular constituents of two specimens of amphibolite, prismatic crystals of scapolite were noticed. The porphyritic feldspathic constituent of the trachytes (acmite-trachytes) corresponds very closely to the soda-microcline of Förstner.[3]

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] Neues Jahrb. fr. Min., etc., Beil. Bd., iv. p. 576.
[3] *Cf.* American Naturalist, Notes, June, 1885, p. 600.

Wollastonite and melanite, which were observed in some of the nephelinites, Mügge thinks must be looked upon as having crystallized directly from the magma of the rock itself, and not as the result of the solution of inclusions. Unfortunately, the author was not able to study these rocks in the field, so that their geological relations are not definitely known.——Bruno Doss[1] has recently made a very thorough investigation of the igneous rocks of Palestine, and as a result of his studies declares them to be labradorite basalts. Their olivine constituent occurs both in porphyritic crystals and in the ground-mass. The two generations are distinguished by the marked differences in their mode of alteration. The mineral of the first generation contains more iron than that of the second, and accordingly gives rise to decomposition products consisting principally of red iron compounds insoluble in acids; while the latter class are merely serpentinized. Twins of olivine were observed in which the twinning planes are $P\breve{\infty}$, and in less frequent instances ∞P. In three specimens pseudobrookite was detected.——The fact that quartz and olivine may occur in the same rock is given additional interest by the discovery in Northern California of a quartz-basalt. This rock is described by Mr. Diller[2] as possessing all the essential characteristics of ordinary basalts, with the addition besides of numerous grains of quartz, many of which are surrounded by a zone of glass and pyroxene. From the fact that quartz is also found in bombs, which must have existed as clots in the lava at the time of its eruption, Mr. Diller is forced to assume that the same magma which under ordinary conditions of temperature and pressure yielded olivine, under different conditions secreted quartz. This quartz-basalt is younger than the ordinary basalts of the region, just as the dacites are younger than the andesites. ——The origin of lithophysæ in the acid lavas of the Yellowstone National Park is the subject of a paper by Mr. Iddings[3] in a late number of the *American Journal of Science.* In it the author inclines to the theory first proposed by Von Richthofen, viz., that this structure is of aqueo-igneous origin, and was produced by the action of absorbed gases upon the molten glass, from which they were liberated during the crystallization consequent upon cooling. Mr. Iddings is led to this view by the facts (1) that the minerals found upon the walls of the lithophysæ (quartz, tridymite, and fayalite) are those which have been produced artificially only by aqueo-igneous methods, and (2) that the chemical composition of the substances of lithophysæ and of spherulites is essentially the same, and therefore the former cannot have been produced by the alteration of the latter.[4]——Chrustschoff[5] has isolated zircon

[1] Min. u. Petrog. Mitth., vii., 1886, p. 461.
[2] Amer. Jour. Sci., Jan. 1887, p. 45.
[3] Ib., Jan. 1887, p. 36.
[4] *Cf.* American Naturalist, Notes, Jan. 1887, p. 70.
[5] Min. u. Petrog. Mitth., vii., 1886, p. 423.

from gneisses, granites, trachyte, basalt, sanidine bombs, and graywackes, and has described the characteristic peculiarities of crystals obtained from these different sources. He has found that the crystals occurring in gneisses always present rounded contours, while those in granite are always defined by sharp crystal planes. He proposes to make use of this fact in distinguishing gneisses with granitic habit from true granites.

Mineralogical News.—*Kaliophilite* is the name proposed by Mierish[1] for a new mineral occurring in colorless needles in one of the Monte Somma bombs examined by him in the course of his work referred to in the March number of this journal. It is a potassium nepheline. An analysis yielded,—

SiO_2	Al_2O_3	CaO	K_2O	Na_2O
37.48	32.43	2.18	27.20	2.26

The author supposes that ordinary nepheline may consist of mixtures of the isomorphous molecules $K_2Al_2Si_2O_8$ and $Na_2Al_2Si_2O_8$, since this mineral always contains more or less potassium. The group of nephelines is now known to consist of at least three members, the third being the mineral eucryptite, discovered by Brush and Dana[2] among the alteration products of spodumene. ——*Scapolite.*—In no manner can the difference in the views of the two schools of mineralogical chemists be better learned than by an examination of the papers relating to the discussion now being carried on in Germany and Austria in regard to the nature of the scapolite group of minerals. In an article in the *Neues Jahrbuch*, Rammelsberg[3] gives his reason for considering this group of minerals as consisting of molecular combinations of normal- (meta-), half- (ortho-), and di- (bi-) silicates of sodium, calcium, and aluminium in certain definite proportions. *Sarkolite*, for instance, he regards as a molecular compound made up of the three ortho-molecules in the proportions $3Na_4SiO_4$, $27Ca_2SiO_4$, $10Al_4(SiO_4)_3$; and *Meionite*, from Mt. Vesuvius, as a similar compound, in which the meta-silicates are present in the proportions of one molecule to six of the ortho-silicates, as,—

$$\left\{\begin{matrix} Na_4SiO_4 \\ 6\left\{\begin{matrix} 4Ca_2SiO_4 \\ 3Al_4(SiO_4)_3 \end{matrix}\right. \end{matrix}\right\} + \left\{\begin{matrix} Na_2SiO_3 \\ 6\left\{\begin{matrix} 4CaSiO_3 \\ 3Al_2(SiO_3)_3 \end{matrix}\right. \end{matrix}\right\} + 20NaCl.$$

Tschermak,[4] on the other hand, regards the members of this group (like those of the plagioclase group) as isomorphous mixtures of the two molecules $4CaO,3Al_2O_3,6SiO_2 = Ca_4Al_6Si_6O_{25}$ and $Na_8Al_6Si_{18}O_{48}Cl_2 = 3Na_2O,3Al_2O_3,18SiO_2 + 2NaCl$, which he calls respectively the meionite and mariolite molecules. By

[1] Tschermak's Min. u. Petrog., Mitth. viii., 1886, p. 156.
[2] Amer. Jour. Sci., III. xx., 1880, p. 257.
[3] Neues Jahrbuch f. Min., etc., Beil. Band, iv., 1886, p. 610; also Sitzb. Berl. Akad., Bd. 30, p. 589.
[4] Min. u. Petrog. Mitth., vii., 1886, p. 400.

the combination of these two molecules in different proportions the various members of the group are formed, and by calculation the proportionate amounts of each present in any given case can readily be determined from the amounts of calcium and sodium found by analysis.——*Bastonite*, a micaceous mineral characterizing certain sandstones and arkoses, is supposed by Renard to be very similar to vermiculite, which Tschermak regards as an altered phlogopite. Its analysis yielded Klement,[1]—

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	H_2O
36.91	20.04	20.01	3.73	trace	0.95	7.96	3.07	0.22	6.98

——According to the investigations of Nordenskiöld,[2] the peculiar fluid inclusions in Brazilian topaz, to which Dana gave the name "brewsterlinite," are, at least in some cases, inclusions of a hydrocarbon, probably of the naphtha group.——Schuster[3] has discovered that the *braunite* from the manganese mines of Jakobsberg, in Wermland, Sweden, is probably isomorphous in crystallization with hematite and ilmenite. Its analysis yielded Igelström,[4]—

SiO_2	MnO	FeO	MgO.CaO	PbO	O
8.7	80.23	1.33	0.95	8.65	8.17

If the iron, magnesium, calcium, and lead be supposed to replace manganese, the composition of the mineral may be represented by the formula $11Mn_2O_3.3MnSiO_3$, corresponding very nearly to the result reached by Rammelsberg in his analysis of the braunite from Elgersburg.

Crystallographic News.—Recent measurements of crystals of *vanadinite* from Pinal County, Arizona, have yielded Mr. Penfield[5] results agreeing closely with those obtained by Urba[6] in his investigations of Carinthian crystals. *Endlichite*[7] [$Pb_5Cl(AsO_4)_3 + Pb_5Cl(VO_4)_3$] from the Sierra Grand Mine, Grant County, New Mexico, was also examined. The axial ratio, as determined by Penfield, is $a:c = 1:.7495$. The presence of arsenic in the mineral seems to tend to increase very perceptibly the length of the vertical axis as compared with that of the pure vanadium mineral (in vanadinite $a:c = 1:.7112$).——The new forms 2O, 11O6, and 6O4 have been observed by E. S. Dana[8] on crystals of native *copper*. In the same paper the author describes crystals which, by development in certain directions, assume the rhombohedral symmetry. The twinning laws of copper are also investigated, and the article concludes with plates containing fifty-

[1] Min. u. Petrog. Mitth., viii., 1886, p. 1.
[2] Neues Jahrb. f. Min., etc., 1886, i. p. 242.
[3] Min. u. Petrog. Mitth., vii., 1886, p. 443.
[4] Annales des Mines de Wermland, 1884, p. 73.
[5] Amer. Jour. Sci., December, 1886, p. 441.
[6] Zeitschrift f. Kryst., iv. p. 353.
[7] American Naturalist, Notes, July, 1885, p. 709.
[8] Amer. Jour. Sci., December, 1886, p. 413.

four illustrations of copper crystals and crystal groupings.——From new measurements of crystals of *hyalosiderite*, the iron-rich olivine, and *forsterite*, the pure magnesian variety, Max Bauer[1] has recalculated the axial relations of these minerals. For the first he finds $\breve{a}:\bar{b}:\acute{c} = .46815:1:.58996$; for the second, $\breve{a}:\bar{b}:\acute{c} = .46476:1:.58569$. On comparing these ratios with those obtained from measurements made on *fayalite*, the pure iron olivine, and other members of this series, the composition of which is known, it is found that an increase in the amount of the magnesium molecule present in any case is accompanied by a shortening of the $\breve{a}$ and $\acute{c}$ axes as compared with the $\bar{b}$ axis.——In the same article Bauer describes twinning lamellæ in massive *barite* from several localities in Germany. The twinning plane is $6P\bar{\infty}$. He regards them as pressure twins like those found in calcite, cyanite, sphene, etc.

Miscellaneous.—In the January number of the *American Journal of Science*[2] Mr. G. F. Becker has an interesting article on "The Texture of Massive Rocks." The subject is treated theoretically, and in such a manner that a brief synopsis of it would be most unsatisfactory. Suffice it to state here that Mr. Becker supposes the formation of plutonic granitoid rocks to represent an extreme and highly exceptional case of neutral chemical equilibrium in a pasty magma, by the cooling of which they were derived. As a rule, however, he regards granular structure as characteristic of metamorphosed sediments.[3] Porphyrite structure is the natural result of slow cooling of a very fluid magma, and is merely the evidence of fractional crystallization of the various minerals. These conclusions are based on a theory of the solidification of minerals in accordance with certain laws of thermo-chemistry.[4]——In a letter to the *Neues Jahrbuch für Mineralogie*,[5] A. Schrauf explains his views on morphotropism and atometrie, which, so far as they relate to minerals, are briefly as follows. The form of crystallization of chemical mixtures depends principally upon the various amounts of their constituents. $MgSO_4 + 7H_2O$ (epsomite) crystallizes in the orthorhombic system, while $FeSO_4 + 7H_2O$ (melanterite) is monoclinic. Mixtures of $MgSO_4 + 7H_2O$ and $FeSO_4 + 7H_2O$ crystallize in the latter system until the proportion of magnesium in the mixture is to the amount of iron as three atoms to one atom $(3MgSo_4 + FeSo_4) + 7H_2O$, when it crystallizes in the orthorhombic system,—*i.e.*, the crystallization is determined by that substance which is in excess (by weight). In the compound $(3MgSo_4 + FeSo_4) + 7H_2O$ the Mg and

[1] Neues Jahrb. f. Min., 1887, i. p. 1.
[2] Amer. Jour. Sci., January, 1887, p. 50.
[3] *Cf.* American Naturalist, Notes, December, 1886, p. 1050.
[4] Amer. Jour. Sci., 1886, p. 120.
[5] Neues Jahrb. f. Min., 1886, i. p. 234.

Fe are to each other as 72 : 56, Mg is in excess, and the substance crystallizes as does $MgSo_4 + 7H_2O$. In compounds containing less Mg (as $2MgSo_4 + FeSo_4) + 7H_2O$, the proportions of Mg and Fe are as 48 : 56, and the crystallization is that of melanterite. Various conditions effect the crystallization of mixed bodies, but the most important of these, according to Schrauf's opinion, is the one mentioned above. If this law is found to be general in its application, the present views in regard to the dimorphism of many compounds belonging to the so-called iso-dimorphous groups will have to be modified.

May 9, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, MAY, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A few specimens of basic eruptive rocks have recently been described by Schmidt[2] from the north side of the Central Alps in Switzerland. Near Iberg, in Canton Schwyz, a diabase porphyrite occurs cutting *Eocene* deposits. This porphyrite presents all the characteristics of pre-Tertiary porphyrites. It offers another proof of the fact that texture in rocks depends more upon the conditions under which the rock magma solidified than upon the age during which it was erupted. The porphyritic crystals are oligoclase. Many of them consist merely of an outer shell of plagioclase substance, including material identical with that of the ground-mass. Melaphyres from near Glarus contain olivine crystals, which have undergone the unusual alteration into bastite.——Messrs. Barrois and Offret[3] have found that the rocks of the Sierra Nevada Mountains in Southern Spain are similar in many respects to those of the Ronda[4] Mountains. They consist principally of a series of highly-altered schists and limestones. The mica schists of this series contain in addition to their essential constituents the accessory minerals rutile, tourmaline, garnet, muscovite, kyanite, sillimanite, andalusite, and occasionally feldspar. Garnet and staurolite are among the oldest constituents. Their shattered condition shows that the rock in which they occur has been subjected to great pressure. The Cambrian schists of this region are divided into sericite schists and chloritoid schists. Members of both series are cut by veins of quartz, with which are associated fluorine minerals, a fact which leads the authors to regard these as the products of the action of gaseous emanations upon the material of the surrounding rock-masses. Among the Cambrian amphibolites is mentioned a variety containing glaucophane, with a greenish-blue tint instead of a violet-blue color parallel to $\mathfrak{b}$. The composition of this glaucophane is:

SiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	loss at red heat
47.42	8.42	9.68	15.28	12.95	2.97	4.16

——A dyke of diabase cutting the old red sandstone near Dumbarton, Scotland, is described by Lacroix[5] as presenting a fine example of the existence in the same rock-mass of three distinct types of structure,—the devitrified glassy, the porphyritic, and the ophitic.——The analyses of several rocks from the neighborhood of Christiania, Norway, have recently been published.[6] The rocks analyzed are, with one exception, from the area occu-

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] Neues Jahrb. f. Min., etc., 1887, i. p. 58.
[3] Comptes Rendus, ciii., 1886, pp. 174 and 221.
[4] *Cf.* American Nat., Notes, June, 1886, p. 549.
[5] Comptes Rendus, ciii., 1886, p. 824.
[6] Jannasch, Ber. d. deuts. chem. Gesell., 1887, i. p. 167.

pied by the prädacite of Lang, and its contact zone. By comparison of the composition of an unaltered slate with that of a hornfels produced by its alteration, it is seen that in this process water and carbon dioxide were driven off, and the ferric iron in the former was reduced to the ferrous state in the latter. The brown mica of the hornfels contains 3.40 per cent. of titanic oxide.

Fulgurites.—Although the interesting bodies known as lightning-tubes have been the subjects of numerous papers during the past century, it must be confessed that our knowledge in regard to them is not very extensive. The United States National Museum having recently become possessed of several fine specimens of the tubular varieties formed by lightning striking in loose sand, Mr. G. P. Merrill[1] has been enabled to study these microscopically, and thus to add something to our previous knowledge of them. In all the cases examined the walls of the tubes consisted of glass, in which there were no traces of crystallization. Analyses of the glass and of the sand in which the fulgurites are found and by the fusion of which they were produced, show that in every case the former contains more silica than the latter. The author argues that "had the lightning shown no selective power the resultant glass would possess the same composition as the sand in which it formed. Had it exercised such power one would naturally expect the most fusible minerals to be first acted on, and hence that the glass would approach them in composition." But the contrary of this seems to have taken place, the ordinarily infusible quartz having been most acted upon. This may probably be explained by supposing the quartz to offer the greatest resistance to the passage of the electric current, —*i.e.*, to be a very poor conductor of electricity. It would then in consequence of this resistance become heated even to the point of fusion, while the better conductors would escape with little injury. The resulting glass would in this case have a higher percentage of silica than the surrounding sand. The actual composition of glass and sand from Union Grove, Whitesides County, Ill., yielded Professor Clarke:

	Loss on ignition	SiO_2	$Fe_2O_3.Al_2O_3$	CaO	MgO	K_2O	Na_2O
Fulgurite glass.....	0.33	91.66	6.69	0.38	0.12	0.73	0.77
Sand.....	1.01	84.83	9.88	1.16	0.13	1.13	1.50

The paper concludes with a very full bibliography of the subject.

Mineralogical News.—A variety of the rare mineral *carphosiderite* is described by Lacroix[2] from the triassic arkoses of Mâcon (Saône-et-Loire). It occurs as micaceous coatings of a

[1] Proceedings of United States National Museum, 1886, p. 83.
[2] Comptes Rendus, ciii., 1886, p. 1037.

golden-yellow color on the walls of cavities and cracks. Examined microscopically, it is seen to consist of pleochroic (colorless and pale yellow) needles in a light yellow non-pleochroic ground-mass. Under crossed nicols the former show bright polarization colors, while the latter remains unchanged during a complete revolution, and is therefore regarded as being made up of the same acicular crystals cut perpendicular to their optical axes, which are negative. The specific gravity of the mineral is 3.09. It is infusible, and when heated in a glass tube gives off water and sulphuric acid. Its composition is:

$$SO_3 = 30.18,\ P_2O_5 = 2.72,\ Fe_2O_3 = 48.52,\ H_2O = 18.48.$$

——In the same journal Gonnard[1] describes pleromorphs of *quartz* after *fluorite*. Curious blocks of milky quartz from St. Clement (Puy de Dôme) are seen, upon close examination, to be made up of spherules composed of acicular crystals of quartz radially arranged around a centre, which is sometimes a void, but more frequently a piece of granite or a core of amorphous silica. Scattered through the blocks are found cavities of octahedral form, normal to the faces of which the quartz-fibres are arranged. Inside of the cavities are also occasionally little octahedrons of quartz with their faces parallel to the walls of the cavity.——Several doubtful minerals have recently been examined microscopically by Dr. Lacroix.[2] *Pterolite*, which Dana supposed to be an altered lepidomelane, Lacroix found to be a mixture of several distinct minerals, of which the most important are a black mica and a strongly pleochroic pyroxene. In addition to these there are also present in pterolite numerous grains of blue sodalite, rhombohedra of calcite or dolomite, and many other minerals which are usually found in eleolite syenites. *Villarsite* is shown to be merely a pseudomorph of chrysotile after olivine. *Gamsigradite* has the optical properties of hornblende, with a maximum extinction of 30° and pleochroism in green and brown tints.——In a late number of the *Neues Jahrbuch für Mineralogie* F. Sandberger[3] discusses the widespread occurrence of iodine in phosphorites, of lithium in psilomelane, and of cassiterite and anatase crystals in zinc-blende and in tetrahedrite. He also describes hexagonal plates of *kaolin*, which he thinks are orthorhombic crystals bounded by the planes oP, $\infty P\breve{\infty}$ and ∞P. They are found in the clefts and druses of a quartz vein occurring on the contact between a lithium-mica granite and a mica schist at the Morgenstern Mine, Joachimsthal. ——In connection with his work on mineral veins the same author[4] had occasion to examine the mica of the Schapbach gneisses and the augite of a diabase from near Andreasberg, Harz. In each he found a silver content of about 0.001 per

[1] Comptes Rendus, ciii., 1886, p. 1036.
[2] Ib., civ., 1887, p. 97.
[3] Neues Jahrb. f. Min., etc., 1887, i. p. 95.
[4] Ib., p. 111.

cent.——The crystals of *phenacite* occurring at various localities in Colorado, according to Mr. Penfield,[1] possess a great similarity of habit to those from the Ilmengebirge, Urals. The phenacite from the Pike's Peak region (as well as the amazon stone and smoky quartz from the same locality) is found in pockets in the neighborhood of the Crystal Peaks,[2] a chain of granite hills about fifteen to twenty miles northwest of Pike's Peak. The crystals from this place are usually small in size, the largest ever found measuring but 15 mm. in length. Most of the crystals are colorless, but those entirely imbedded in gangue have a faint wine color.——Mr. A. N. Alling[3] has recalculated the physical constants for topaz from measurements of a crystal of this mineral from Thomas Range, Utah. The axial ratio as recalculated is $\breve{a} : \bar{b} : c' = 0.5285 : 1 : 0.47715$. The optical angle, $2V = 67° 18'$; and the indices of refraction are $\beta = 1.6104$ and $\gamma = 1.6176$ for yellow light.

Chemical Integration.[4]—The author regards all chemical species known to us as units or integers produced by the identification in volume, or, in other words, the integration of more elemental species. Rejecting the atomic hypothesis which he has long regarded as, in the language of J. P. Cooke, "a temporary expedient for representing the facts of chemistry to the mind," the author designates the so-called molecular weights of species as their integral weights. They are, at the same time, equivalent weights, since they are the weights of equal volumes. The specific gravity at 0° and 760 mm. of hydrogen gas, which is the unit of combining weight, should, in his opinion, be made the unit of specific gravity for all species. The integral weights for gases and vapors are well known to be multiples of this unit of specific gravity, and, believing the law of condensation by volume to be universal, the author conceives all liquid and solid species to be formed by the condensation or so-called polymenzation of normal gaseous species often unknown to us. From this he concludes that the specific gravity of these liquids and solids should be calculated on the basis of hydrogen as unity. In this way the problem of the coefficient of condensation is solved.

We had long maintained that the law of progressive series is also, like that of volumes, universal in chemistry, applying not only to related hydrocarbons, but to species differing in the proportions of oxygen, of sulphur, of metals, and of hydrogen. In the existence of such series he finds an explanation of those apparent variations in the law of definite proportions, seen alike

[1] Amer. Jour. Sci., xxxii., Feb. 1887, p. 130.
[2] W. B. Smith, Ib., p. 134. [3] Ib., xxiii., Feb. 1887.
[4] Abstract of paper read before Nat. Acad. Sciences, April 19, 1887.

in solid and in gaseous species, upon which several chemists have in late years insisted.

The question of heterogeneous and of homogeneous differentiation or disintegration in gases is also discussed at length, as well as several other related problems, all of which have been previously noticed in the author's lately-published volume, entitled "A New Basis for Chemistry," to which the present paper is a supplement.—*T. Sterry Hunt.*

Miscellaneous.—By subjecting mixtures of zinc salts and sulphates of sodium or potassium to a high temperature Alex. Gorgeu[1] has succeeded in obtaining little hexagonal prisms and plates of zinc oxide with the hardness and density of the natural *zincite.* By the addition of a small quantity of manganese sulphate to the mixture before heating, the crystals obtained possessed the pink color of the natural mineral. *Willemite* was produced by calcining a mixture of one part zinc sulphate, one-half to one part sodium or potassium sulphate, and one-thirtieth part hydrated silica. The crystals obtained were in the form of hexagonal prisms, terminated by an obtuse rhombohedron. They corresponded in all their properties with the naturally-occurring willemite.——Bourgeois[2] has effected the syntheses of several crystallized carbonates by heating their corresponding amorphous carbonate precipitates to a temperature of 100° in glass tubes containing a solution of some ammoniacal salt. Calcium, strontium, and barium carbonates crystallized as *calcite, strontianite,* and *witherite.* The first was accompanied by some aragonite. Lead carbonate crystallized as cerussite and hydrocerussite, and cadmium carbonate formed little crystals corresponding to calcite. The same results were reached by heating solutions of the saline salts with ammonium carbonate at 140°. ——Brazilian *topaz* possesses an electrical axis which does not correspond to any crystallographic axis.[3]——E. Cohen[4] has described pseudomorphs after the concretionary *markasite* occurring in the chalk at Rügen, Pomerania. The pseudomorphs are composed of a mixture of 9.88 per cent. silica, 11.93 per cent. copiapite, and 78.19 limonite.

[1] Comptes Rendus, civ., 1887, p. 120; Bull. d. l. Soc. Chim. d. Paris, xlvii., Feb. 1887, p. 146.
[2] Ib., ciii., 1886, p. 1088; Bull. d. l. Soc. Chim. d. Paris, xlvii., Jan. 1887, p. 81.
[3] K. Mack, Pogg. Annalen, 1886, No. 6, p. 153.
[4] Sitzb. d. Naturw. Ver. f. Neuvorpommern u. Rügen, 1886.

June 6, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, JUNE, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The second[2] paper devoted to the study of the massive rocks belonging to the "Cortland series" on the Hudson River, near Peekskill, has recently appeared in the *American Journal of Science*.[3] In this paper the author, Dr. G. H. Williams, describes the norites and related rocks, which make up by far the greater part of the entire Cortlandt series. These norites are divided into norites proper, hornblende norites, mica norites, hyperites or augite norites, and pyroxenites. The norite proper is very rare, almost all sections showing the presence in small quantity of minerals which would, in accordance with a strict classification, require the rock to be placed in one of the other four groups. The most interesting facts brought out in the examination of these rocks are (1) the occurrence of orthoclase in several specimens, and (2) the existence of numerous inclusions in this orthoclase and in the more prevalent andesine. The orthoclase is in porphyritic crystals, in which are sometimes imbedded smaller crystals of plagioclase. Under the microscope the former is seen to possess a "shagreen" surface, due to numerous oval indentations. All the feldspar of the norites is filled with little inclusions of plates, rods, and dots. These seem not to be arranged in any definite position with regard to crystallographic

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] *Cf.* American Naturalist, March, 1886, p. 275.
[3] Amer. Jour. Science, xxxiii., February, p. 135; March, p. 191.

planes, as demanded by Judd's shillerization theory, but are grouped in zones. They are regarded by Dr. Williams as original and representing the forms in which the iron first separated from the magma, this separation occurring contemporaneously with the crystallization of the feldspar. Many of the mica norites possess a well-marked schistose structure, a fact which led Professor Dana[1] to ascribe to them a metamorphic origin from sedimentary deposits. A study of their thin sections, however, shows this schistosity to be but another instance of the secondary development of this structure by pressure. The iron ore and emery deposits of this region were also examined. This ore is composed essentially of octahedral crystals of magnetite imbedded in a dark green mineral with the composition and optical characteristics of hercynite (or pleonaste, with a very low percentage of magnesium). This mineral is also found disseminated in small octahedral crystals in the rock adjoining the ore veins. Associated with the magnetite and hercynite of the ore occur also fibrolite and corundum.——The same author, in a communication in *Science*,[2] declares, as the result of microscopical examination, that the serpentine occurring at Syracuse, N. Y., must be regarded merely as an altered peridotite. The remains of bronzite crystals can still be detected in the rock, and consequently the view of Professor Sterry Hunt, that it must be looked upon as an altered sediment because of its intimate association with sedimentary beds of gypsum, can no longer be maintained.——In a preliminary "Note on the Volcanic and Associated Rocks of the Neighborhood of Nuneaton," England, T. H. Waller[3] mentions the occurrence there of ashes (tufa) composed of pieces of feldspar, a little quartz, and grains of some basic rock; a felsite with porphyritic crystals of quartz, in which lines of secondary fluid inclusions are well exhibited; a diabase porphyrite with augite twinned according to both twinning laws,—viz., parallel to oP and $\infty P\bar{\infty}$; and, finally, indurated quartzites with the individual quartz grains enlarged by the addition of new quartz material whose optical orientation is identical with that of the original grains.——In connection with the statement of Dr. Williams in regard to the serpentine of Syracuse, it may be of interest to call attention to an article in which J. H. Collins[4] cites several examples to prove that "some beds of a common series have been changed into serpentine, while others (pass over) into hornblende schist." He thinks that many of the serpentines of Cornwall, which have heretofore been regarded as having originated by the alteration of intrusive sheets of picrite, may as well be considered as having originated in some other manner.

[1] Amer. Jour. Science, xx., 1880, p. 218.
[2] Science, March, 1887, p. 232.
[3] Geological Magazine, July, 1886, p. 322.
[4] Ib., August, 1886, p. 359.

Meteorites.—Very recently the name *giovanite* has been proposed by Meunier[1] for a brecciated[2] meteoric stone which fell at San Giovanni d'Asso, near Siène, in Italy, in 1794. Specimens of this same fall have been described previously, but the individual pieces were so small that the interesting facts which Meunier has discovered upon the examination of a larger specimen were overlooked. Meunier finds that this giovanite is made up of fragments of the rock limerickite cemented together by a substance with all the characteristics of leucite,—*i.e.*, the relations of these two substances are inversely what they are in *mesminite*, in which fragments of leucite are imbedded in limerickite. After briefly discussing the subject of the origin of this structure, Meunier concludes that there must be a community of origin for various meteoric rocks, and that in this common place of origin geological action (as we understand it) must exist. He further states that the analogy which it is sought to establish between meteors and comets (and shooting-stars) cannot be maintained.——Two meteors of considerable ethnological interest are described by Mr. G. F. Kunz[3] in the *American Journal of Science* for March. The first is a meteoric stone composed of rounded and angular pieces of olivine in a ground-mass consisting of iron. Analyses of the two constituents yielded Mr. Mackintosh the following figures:

Olivine: $SiO_2 = 37.90$; $MgO = 41.65$; $FeO = 19.66$; $MnO,CoO = 0.42$.
Iron: $Fe = 82.45$; $Ni = 16.40$; $Co = 1.09$; $P = 0.05$.

The author regards this meteor, which was found in Carroll County, Kentucky, as part of the same mass from which the iron was obtained for making the iron ornaments found in the Turner and the Liberty groups of mounds in the Little Miami Valley, Ohio. The second mass was found near Catorze, San Luis Potosi, Mexico, in 1885. It weighs ninety-two pounds. Its composition (analysis by Mackintosh) is: $Fe = 90.09$; $Ni,Co = 9.07$; $P = 0.24$; schreibersite $= 0.60$. It resembles in character the irons of Augusta County, Va., of Glorieta[4] Mountain, and others of the class caillite (Meunier). In a cylindrical cavity in this meteor can still be seen the broken end of a copper chisel. ——The ninth meteoric iron which has actually been seen to fall has recently come into the possession of Mr. W. E. Hidden.[5] The mass weighed before polishing three thousand nine hundred and fifty grammes. It was seen to fall on the evening of the 27th of November, 1885, during the periodic star shower of the "Bielids." The location of the fall is near Mazapil, in the state of Zacatecas, Mexico. According to the belief of Professor

[1] Comptes Rendus, civ., Jan. 1887, p. 193.
[2] *Cf.* American Naturalist, Jan. 1887, p. 73; and Dec. 1885, p. 1213.
[3] Amer. Jour. Sci., xxxiii. p. 228.
[4] *Cf.* American Naturalist, Jan. 1887, p. 73.
[5] Amer. Jour. Sci., xxxiii., 1887, p. 221.

José A. y Bouilla, Director of the Astronomical Observatory at Zacatecas, this meteor represents part of the comet Biela-Gambert, lost since 1852. It is characterized by the freshness of its surface, which shows very perfectly the flow of the melted crust, and by the presence of unusually large nodules of a very compact graphite. For some time after its fall it remained red-hot. Its analysis yielded Mr. Mackintosh 91.26 per cent. of iron, 7.845 per cent. of nickel, 0.653 per cent. of cobalt, and 0.30 per cent. of phosphorus. Carbon is distributed all through the mass between the crystalline plates.——Mr. Huntington[1] calls attention to the fact that the Maverick County, Texas, meteorite[2] possesses many of the characteristics of the Coahuila irons, described by the late J. L. Smith, and from the similarity of the two concludes that the former must be classed as one of the latter, and should not be regarded as an independent fall.——In connection with meteorites it may be of interest to note the discovery by Meunier[3] of little globules of a stony matter in the ashes of Krakatau. Upon examination they are found to be made up of little crystals of augite and plagioclase in a vitreous ground-mass. The author calls attention to the similarity between these bodies and the chondra of certain meteorites.

Recent Publications.—It is unfortunate that a treatise written expressly for the use of students should contain so many inaccuracies as are noted in the recent "Elements of Geology" by Professor A. Winchell.[4] Whatever may be said of the rest of the book, that portion which treats of petrography and the optical properties of minerals will not serve to give the beginner any definite idea of the fundamental principles upon which all rock classification is now based. Many of the statements made are, to say the least, misleading, and the definitions of the various rock types are unsatisfactory.——An excellent text-book of Mineralogy, by Max Bauer,[5] appeared about a year ago. It is by far the best book for general use in the class-room that has yet been published. The chapters on the development of the principles of crystallography are to be recommended as especially well adapted to the use of those beginning the study of the subject.——Ferdinand Henrich's[6] text-book of Mathematical Crystallography will fill a long-felt want of those who desire to gain some knowledge of the methods in use for the measurement and calculation of crystal forms, crystallographic constants, twinning planes, etc. The work is well written, and the directions given in it are all clearly and concisely expressed. Wherever it can aid the explanation of a difficult point examples

[1] Amer. Jour. Sci., xxxiii., 1887, p. 115. [2] *Cf.* Amer. Naturalist, Jan. 1887, p. 73.
[3] Comptes Rendus, civ., 1887, p. 95.
[4] Geological Studies, or Elements of Geology. Chicago: Griggs, 1886.
[5] Lehrbuch der Mineralogie. Berlin und Leipzig, 1886. J. Guttentag (D. Collin).
[6] Lehrbuch der Krystallberechnung. Stuttgart, 1886. Euke.

are introduced and calculations are made in full, just as in ordinary practice. Miller's system of indices is used throughout, and the rules for making spherical projections are developed at some length. This is the only elementary text-book in which the subject of spherical projection is given the attention it naturally merits as being the method which is now almost universally used by the most eminent crystallographers.

Among the publications of the last few months which contain more or less of interest in mineralogy and petrography may be mentioned—

Professor A. Kenngott, M.D.—Handwörterbuch der Mineralogie, Geologie und Palaeontologie, III. Breslau, 1887. Eduard Trewendt.

Dr. C. Rieman.—Taschenbuch für Mineralogen. Berlin, 1887. Julius Springer.

F. Toula.—Mineralogische und petrographische Tabellen. Leipzig. Freytag.

J. D. Dana.—Manual of Mineralogy and Petrography.[1] 4th ed., 1887. New York: John Wiley & Sons.

Professor W. O. Crosby.—Tables for the Determination of Common Minerals, chiefly by the Physical Properties, with confirmatory Chemical Tests.[2] Boston, 1887. A. Crosby.

Professor A. H. Chester.—Catalogue of Minerals Alphabetically Arranged, with their Chemical Composition and Synonyms.[2] New York, 1886. John Wiley & Sons.

T. Sterry Hunt.—Mineral Physiology and Physiography.[2] Boston, 1886. S. E. Cassino.

Professor W. O. Crosby.—Geological Collections. Mineralogy. Boston Soc. Nat. History, 1886.

A. C. Lawson.—Report on the Geology of the Lake of the Woods Region. Part CC. Annual Report of the Geological and Natural History Survey of Canada. Montreal, 1885.

C. D. Lawton.—Mineral Resources of Michigan for 1885. By authority. Lansing, 1886. Thorp & Godfrey.

Mineral Resources of the United States for 1885. Washington, 1886. Government Printing Office.

Dr. P. Groth.—Grundriss der Edelsteinkunde. Leipzig, 1887. Engelmann.

[1] Reviewed in Science, 1887, p. 304.
[2] Reviewed in Science, February, 1887, p. 142.

June 29, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, JULY, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In the August number of the *Geological Magazine* Mr. J. J. H. Teall[2] describes an interesting suite of hornblende rocks which occur as intrusive sheets and bosses in the limestones and quartzites of the Assynt district in Scotland. From the description which the author gives of them, these rocks appear to be somewhat similar to the camptonite of Dr. Hawes.[3] Three types are distinguished,—viz., hornblende porphyrites, diorites, and porphyrite diorites. In the last two classes hornblende is abundant in well-formed porphyritic crystals, bounded by the planes ∞P, $\infty P\bar{\infty}$, $-P$ and oP. Some of the larger of these crystals are so perfectly developed that when separated from the surrounding rock-mass their angles can be measured with a contact goniometer. Most of them are twinned according to the ordinary law, and many present fine instances of zonal

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] Geol. Magazine, August, 1886, p. 346.
[3] Lithology of New Hampshire, p. 160, *et seq.*; Rosenbusch's Massige Gesteine, 1886, p. 333.

growths. In the hornblende porphyrites the hornblende crystals are less abundant. This class is characterized by the presence of feldspar in two generations. The porphyritic crystals are sharply outlined, and are developed in thick tables parallel to the clinopinacoid. They often show zonal banding, due to the variations in the optical characteristics of successive layers. The feldspar of the second consolidation occurs in grains, often forming the greater part of the ground-mass in which the crystals of hornblende and feldspar are found. In addition to these minerals, a very light-colored pyroxene is present in those sheets which are intrusive between limestone.——The same author[1] mentions another instance of the development in eruptive rocks of a schistose structure, accompanied, at the same time, by a change in mineralogical composition.[2] The normal gabbro of the Lizard peninsula in Cornwall is intrusive in serpentine and other rocks, and is itself penetrated by dykes of epidiorite. It is composed of diallage, hornblende, and saussuritized plagioclase, with here and there a little fresh olivine. The hornblende is secondary and of three varieties,—a compact brown, a uralitic, and an actinolitic variety. The saussuritization of the plagioclase and the alteration of the original augite into hornblende appear to increase as the pressure to which the rock-mass was subjected is seen to have been greater. Generally, though not always, the alteration in the composition of the rock is accompanied by a change in its structure. The massive character of the normal rock is lost, and a secondary schistose structure takes its place. These schistose rocks the author calls flaser-gabbros, augen-gabbros, and gabbro-schists. In the first the parallel arrangement of the constituents is distinct, but not so marked as to give rise to that perfect fissility characteristic of the third class. The augen-gabbros are similar in structure to the well-known augen-gneisses. These different types of structure, as well as the alteration in the original composition of the rock, the author regards as results of the action of pressure, which in some cases was so great as to give rise to faults.——The hyperesthene crystals from the hyperesthene andesite of Pokhausz, Hungary, have been isolated and examined by A. Schmidt.[3] The rock in which they occur consists of a dark gray isotropic ground-mass, in which the hyperesthene and plagioclase are scattered in porphyritic crystals. The grass-green augite of the amphibole-andesite from near Kremnitz has likewise been isolated and examined.——The igneous rocks of the Warwickshire coal-field, according to Professor Rutley,[4] are syenites, andesites (English), quartzites, diorites (both augitic and olivenitic), and tufas.

[1] Geol. Magazine, November, 1886, p. 481.
[2] *Cf.* American Naturalist, December, 1886, p. 1049.
[3] Zeits. f. Krystall., xii. p. 97.
[4] Geol. Magazine, December, 1886, p. 557.

Mineralogical News.—In 1871, Tschermak discovered that the optical characteristics of the various pyroxenes depended in great measure upon the proportion of their iron constituent. He found that with increase of iron there was a corresponding increase in the size of the optical angle, and also in the inclination of the acute bisectrix to the vertical axis of the monoclinic varieties. In later years Wiik, Herwig, and Doelter examined monoclinic pyroxenes with the view of deciding as to whether Tschermak's observations would be found to apply generally. Their results, however, were not conclusive. Very recently G. Flink,[1] of Stockholm, declares, as the result of investigations made on *diopside*, *schefferite*, and *rhodonite*, that the crystallographic angle β varies with variation in the percentage of iron, increasing with the increase of this constituent and decreasing with its decrease, but within very small limits (22′). The morphotropic action of manganese is to diminish the size of the angle and to carry the crystallization of the pyroxene over to the triclinic system. The value of this angle for different proportions of manganese is given as follows:

Diopside (Mn = free).	Schefferite (MnO = 8.32%).	Rhodonite (MnO = 41.88%).
74° 11′	73° 53′	71° 15¼′

The optical angle and the angle of extinction in the plane of symmetry both increase with the rise in the percentage either of iron or manganese. The geometrical, optical, and chemical properties seem to show that the diopsides among the pyroxenes form a continuous series analogous to the plagioclase series among the feldspars.——In the course of the above investigation Flink had occasion to work over a large series of diopside, schefferite, and rhodonite crystals, the results of which he incorporates in his paper. On *diopside* from Nordmark, Sweden, he finds the following new forms: $\infty P\breve{5}$, $\infty P\breve{7}$, $\frac{4}{3}P\bar{\infty}$—$2P\bar{\infty}$, —$\frac{1}{9}P$, and $\frac{1}{5}P\breve{\infty}$. *Schefferite* is the name given by Mikaelson to a manganese-rich diopside from Längban. According to Flink its composition is:

SiO_2	CaO	MgO	MnO	FeO
52.28	19.62	15.17	8.32	3.83

It crystallizes in red, brown, or black crystals bounded by the planes oP, P, $P\bar{\infty}$, 2P, $\infty P\bar{\infty}$, ∞P, and —P. The habit of these is determined by the greater or less development of the three planes oP, $P\bar{\infty}$, and P. Twins are very common according to the ordinary law of the pyroxenes. The axial ratio is: a : b : c = 1.1006 : 1 : 0.59264. $\beta = 73° 53'$. In thin section the mineral is almost colorless. It possesses very weak pleochroism. It extinguishes 44° 25½′ in the clinopinacoidal section, is positive and 2Va = 65° 3′ for yellow light. *Rhodonite* usually occurs massive. But few fine crystals have heretofore been described. In the article under

[1] Zeitschrift f. Kryst., xi. p. 449.

discussion Flink mentions the fact that he has become possessed of a large collection of good crystals from Pajsberg and Långban. These he examines, and finds on them nineteen forms new to the species. The axial ratio as calculated from his measurement is: $a:b:c = 1.0727:1:0.52104$. The inclinations of the axes to each other are $\alpha = 76° 41' 52''$, $\beta = 71° 15' 15''$, $\gamma = 81° 39' 16''$. The plane of the optical axes is inclined to oP and ∞'P at 63° and 38½° respectively. It corresponds to $\frac{3}{2}$,P,$_{\overline{16}}$. The acute bisectrix is perpendicular to the plane $\frac{6}{8}$P,$_{\overline{17}}$ and is probably negative. $2Va = 76° 12'$ for sodium light and $\rho < \upsilon$ absorption $\mathfrak{b} > \mathfrak{a} > \mathfrak{c}$—. The intergrowth of minerals of analogous composition has within the past few years been proven to be very much more common than was formerly supposed. The microscope has revealed the fact that very many rock-forming minerals, as, for instance, the pyroxenes and the feldspars, very frequently occur intergrown with lamellæ of analogous but slightly different composition. The method of etched figures has shown the same statements to hold good in regard to minerals which occur only in massive form. By the latter means Baumhauer[1] has succeeded in detecting irregular intergrowth of various substances in *cloanthite* and *smaltite*. The occurrence of thin lamellæ of *ilmenite* in crystals of *magnetite* from the chlorite-schist of Greiner in the Zillerthal, is placed beyond doubt by the separation and analysis of the two components of these crystals by Cathrein.[2] ——Little *bournonite*[3] crystals cover the cubic faces of galena from Přibram. Their long axes are either parallel to the combination edge between $\infty O\infty$ and O, or they are inclined to this at an angle of 45°.

Crystallographic News.—The twinning law of *lepidolite*[4] from Schüttenhofen, in Bohemia, is the same as that for the more common micas,—*i.e.*, the twinning plane is ∞P. The dispersion of the axes is very similar to that in the hemihedral crystals of the orthorhombic system. Intergrowths of muscovite and lepidolite take place parallel to the twinning position of micas of the same composition.——Several brief communications on the crystallography of *topaz* have lately appeared. In one H. Bücking[5] discusses the forms appearing in the topaz of Mexico, with reference more particularly to the Durango crystals.[6] A large number of new planes have been detected. A second article, by Fr. Feist,[7] describes a crystal of topaz from the Ilmengebirge.

The *Zeitschrift für Krystallographie* for the past few months has contained quite a number of short articles descriptive of single

[1] Zeits. f. Kryst., xii. p. 18.
[2] Ib., p. 40.
[3] C. Hintze, ib., xi. p. 606.
[4] R. Scharizer, ib., xii. p. 1.
[5] Ib., pp. 424 and 451.
[6] *Cf.* also Des Cloizeaux, Bull. d. l. Soc. franç. de Min., 1886, p. 135.
[7] Zeits. f. Kryst., xii. p. 434.

crystals of different minerals from various localities. Gehmacher[1] gives a series of measurements on the faces of colorless *zircon* crystals from the Pfitschgrund, in the Tyrol.——The axial ratio of *datholite* from the Seisser Alps, as calculated by Riechelmann,[2] is a:b:c=0.63584:1:0.6329. The angle $\beta=89° 54'$.——The new forms $\frac{1}{40}P$, $\frac{1}{28}P$, $\frac{1}{5}P_{\frac{2}{3}}$, $\frac{3}{13}P_{\frac{3}{2}}$, $\frac{5}{3}P_{\frac{5}{2}}$, and $\frac{3}{4}P\frac{9}{4}$ (?) have been added to the list of planes occurring on *anatase*[3] by Seligmann.——The same investigator has measured *pyrrhotite* from the druses of basalt from the Cyclopean Islands. The results indicate that the mineral crystallizes in the hexagonal system with the axial ratio: 1 : 1 : 1 : 1.65022.——In the same article Seligmann describes a *wolframite* crystal from the Sierra Almagrera in Spain, on which are the two new forms $-2P_{\frac{3}{2}}$ and $-3P\frac{3}{2}$. The mineral is monoclinic with the axial angle $\beta=90° 26'$ and the axial ratio 0.82144 : 1 : 0.87111.——New crystallographic planes have also been discovered by Sansoni[4] on calcite from Blaton, Belgium.——Sansoni[5] also mentions the fact of the tendency in *barite* crystals from Vernasca, Italy, for the prismatic and end faces to converge towards the free end of the axis to which they are parallel, and along which the crystals have their greatest development.

Miscellaneous.—The diamonds found in the African diamond-fields occur[6] in the immediate neighborhood of volcanic pipes cutting carbonaceous strata of Triassic age, and containing as inclusions pieces of the shales forming the greater part of the series, through which they break. The richest yield of the gem is obtained from the outer portion of the pipes, where the included fragments are most abundant. The rock composing the lower portion of the pipes is quite fresh. It is a peridotite of which certain portions are diamantiferous, while other portions contain no diamonds. The diamantiferous variety is crowded with fragments of shale, while the non-diamantiferous variety is free from them. From these and other facts it is concluded that the diamonds are secondary minerals produced by the reaction of the lava (with heat and pressure) on the carbonaceous shales in contact with and enveloped by them. A study of the occurrence of diamonds in other regions seems to indicate the correctness of this conclusion, as Mr. Diller[7] points out the fact that in most American localities where diamonds are known to occur the same relation of carbonaceous shales and very basic eruptive rocks has been observed to exist. Mr. O. A. Derby,[8] on the other hand, does not accept this explanation for the origin of the

[1] Zeits. f. Kryst., xii. p. 50. [2] Ib., p. 436.
[3] Ib., xi. p. 337. [4] Ib., p. 352. [5] Ib., p. 355.
[6] H. C. Lewis, Geol. Magazine, January, 1887, p. 22.
[7] Science, Oct 1886, p. 392; also Geol. Survey of Kentucky; Report on the Geology of Elliott Co., p. 27.
[8] Science, Jan. 1887, p. 57.

diamonds of the Brazilian fields.——In the lower greensands at Flitwick and Sandy, in Bedfordshire, England, Mr. A. G. Camero[1] has found ironstone nodules filled with water, which they lose by evaporation when left exposed to the action of dry air.

[1] Geol. Magazine, August, 1886, p. 381.

(EXTRACTED FROM THE AMERICAN NATURALIST, AUGUST, 1887.)

MINERALOGY AND PETROGRAPHY.[2]

Petrographical News.—Very recently Professor Judd[3] has undertaken to show that his schillerization theory[4] is founded upon well-known facts. In addition to the planes of least cohesion (cleavage planes) and the gliding planes, there is a third series of planes in crystals,—the solution planes, along which the solution of the crystal takes place most readily. These are distinct from both the cleavage and the gliding planes, and their position in the crystal is dependent upon its symmetry. When a crystal fragment is subjected to the action of a solvent, solution begins along these planes, little irregular-shaped hollows appear, and as these grow larger they assume the form of negative crystals. These hollows gradually become filled with secondary substances, and in this way arise the inclusions, which

[2] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[3] American Naturalist, Dec. 1885, p. 1216.
[4] Geological Magazine, vii., Dec. 1886, p. 81.

produce the peculiar shimmer on faces of the crystal parallel to the planes along which the inclusions are arranged,—*i.e.*, the solution planes. After showing that secondary solution planes may be produced in directions parallel to directions of pressure, as in the case of a faulted quartzite pebble, and that the repeated twinning of a mineral may also give rise to them, the author describes various stages in the process of schillerization, as seen in thin sections under the microscope. This theory is not intended to apply to all cases of inclusions arranged in definite planes in minerals, but only to those which at the same time show some indication of regularity of form, as in labradorite, hypersthene, etc.——On the road between Verrex and St. Vincent, in the Val d'Aoste, Professor Bonney[1] has found a schistose glaucophane-eclogite interbedded with quartz-mica schists, limestone, and green schists. The rock consists of pale wine-red garnets, with inclusions of hornblende, glaucophane, and dust, a green hornblende, glaucophane both in irregular grains and in well-developed crystals, epidote, mica, and sphene (leucoxene). In this connection the author describes in some detail the glaucophane-gabbro of Pegli, near Genoa. This rock was described by Williams[2] as an amphibolite, but Bonney prefers calling it gabbro. The glaucophane appears to have been secondarily derived from diallage.——Specimens of kaolinized granite from St. Austell, Cornwall, indicate to F. H. Butler the close association of tourmaline with the progress of the alteration in the original granite.——According to Professor Bonney,[3] the Rauenthal serpentine is not the result of the alteration of amphibolite, as was supposed by Weigand,[4] but has been derived from an olivine-hornblende rock resembling certain picrites. To this view Mr. Teall takes exception. He states[5] that his examination of the rock confirms the deductions of Weigand, and that the serpentine is the product of the alteration of hornblende.——The elastic sandstone of Delhi, Germany, according to O. Mügge,[6] is composed of quartz grains intricately interlocking, and a very little interstitial clayey material. Most of the cement has been removed by the action of percolating waters, and in the interstices thus left the individual quartz grains have grown by the addition of silica in crystallographic continuity with the substance of the original grains. This growth, however, ceased before the occupancy of the entire space. It is to the abundance of these cells that the sandstone owes its elasticity.——Gonnard mentions the occurrence of phillipsite, chabasite, and apophyllite in the vacuoles of the basalt

[1] Geological Magazine, vii., July, 1886, p. 1.
[2] Neues Jahrb. f. Min., 1882, ii. p. 201.
[3] Geol. Magazine, Feb. 1887, p. 65.
[4] Min. u. Petrog. Mitth., 1875, p. 175.
[5] Geol. Magazine, March, 1887, p. 137.
[6] Neues Jahrb. f. Min., 1887, i. p. 195.

of Prudelles, Puy-de-Dôme.[1]——A mica-gneiss similar to the granulite of Törnebohm is described by Sjögren[2] as occurring in the iron regions of the Banat. Sjögren finds that the ores are not connected genetically with the intrusion of banatite, as has heretofore been supposed.——In his geological sketch of part of the Galician-Hungarian East Carpathians Dr. H. Zapalowicz[3] gives a few notes on the schists and intrusive rocks occurring in the more mountainous regions of the Carpathians.

Mineralogical News.—*Stüvenite* is the name proposed by Darapsky[4] for a mineral from the Alcaparroso Mine, near Copiapó, in Chili. Its analysis yielded:

SO_3	Al_2O_3	MgO	Na_2O	K_2O	H_2O
36.1	11.6	1.0	2.7	trace	47.6

This corresponds to a composition represented by the formula $(\frac{1}{2}Na_2\frac{1}{2}Mg)SO_4 + Al_2(SO_4)_3 + 24H_2O$. The mineral occurs in acicular crystals grouped in radial masses. Before the blowpipe it presents the features of the alums, to which group of minerals the new substance probably belongs.——In the same paper in which stüvenite is described Darapsky records the results of the analyses of a large number of Chilian alums, principally of the feathery variety, and gives a list of all the alums investigated up to the present time. These he divides (following Dana) into the regular alums and the halotrichites, to which subdivision the above-noted stüvenite belongs. The names of seventeen distinct minerals are included in the list.——Hintze[5] proposes *arsenolamprite* as the name for Chilian arsenic, which possesses physical properties different from those of ordinary arsenic. The composition of the mineral is:

As	Fe	SiO_2	
98.20	0.96	0.30	(Mean of two analyses).

Specific gravity is 5.50. It is soft, and of a brilliant metallic lustre. It is probably identical with the arsenglanz of Breithaupt, from Marienberg, in Saxony.——In 1881, Luedecke attempted to show that *mesolite*, *natrolite*, and *scolecite* form an isomorphous-trimorphous group, the first mineral crystallizing in the orthorhombic, monoclinic, and triclinic systems, natrolite in the orthorhombic and monoclinic, and scolecite in the monoclinic and triclinic systems. C. Schmidt[6] recently having the opportunity to reinvestigate the crystallography of scolecite, declares that this mineral crystallizes only in the monoclinic system, and that the triclinic variety described by Luedecke was

[1] Comptes Rendus, civ. p. 719.
[2] Jahrb. d. k. k. geol. Reichsanst, 1886, p. 607.
[3] Ib., p. 361.
[4] Neues Jahrb. f. Min., 1887, i. p. 125.
[5] Zeits. f. Kryst., xi. p. 607. [6] Ib., p. 587.

probably merely a monoclinic twin, whose twinning plane is the clinopinacoid. Since Rammelsberg[1] has shown that the orthorhombic mesolite (galactite) is probably natrolite, and since this mineral is found only in orthorhombic crystals, there has as yet been no proof given to show that either of the three minerals mentioned crystallizes in more than one system.——A. Becker[2] has analyzed *alstonite* and *barytocalcite* from Alston Moor, in order to decide as to whether Groth's view in regard to the composition of these substances is well founded. Both minerals are carbonates of calcium and barium, alstonite crystallizing in the orthorhombic system, and barytocalcite in the monoclinic. From the fact that calcium carbonate has never been found in monoclinic crystals, whereas, on the other hand, an orthorhombic variety is well known, Groth supposed that alstonite is an isomorphous mixture of the carbonates of barium and calcium, while barytocalcite is a molecular compound of the formula $BaCa(Co_3)_2$. Becker's results indicate the truth of this supposition. The composition of alstonite may be represented by $BaCa(Co_3)_2$; that of barytocalcite by $X\ BaCo_3 + YCaCo_3$.——In the ruins of old mines in the neighborhood of the Windgälle, in Canton Uri, Switzerland, are found oolitic masses composed of a brown or green substance in little elliptical and lenticular grains cemented together by carbonate of lime. These little grains are themselves made up of scaly magnetite and a bright-green, weakly-dichroic mineral,[3] with aggregate polarization. This was separated by Thoulet's solution, freed as perfectly as possible from the associated carbonate, and subjected to analysis, with the following result:

SiO_2	Al_2O_3	FeO	MgO	H_2O
25.23	19.97	37.51	4.39	12.90

Upon comparison of these figures with those found by Boricky for the *chamoisite* from Chrustenic, in Bohemia, the two minerals were found to be almost identical in composition, after allowing for the impurities in the Chrustenic mineral. Chamoisite is thus shown to be the alumina-rich and ferric-iron-free member of the series to which cronstedtite and thuringite belong.——The ferric sulphate *botryogen*, from Fahlun, in Sweden, has been examined by Hockauf.[4] The mean of two analyses yielded:

So_3	Fe_2O_3	FeO	MnO	CaO	MgO	H_2O
36.94	16.38	2.23	1.93	0.90	7.63	33.99,

corresponding to the formula $FeSo_4 + [Fe_2(So_4)_3 + (FeO)_2So_4]$. The botryogen of commerce was also analyzed, and found not to have the composition of the genuine mineral.

[1] Mineralchemie, ii., Aufl. 2, p. 633.
[2] Zeits. f. Kryst., xii. p. 222.
[3] C. Schmidt, ib., xi. p. 597.
[4] Zeits. f. Kryst., xii. p. 240.

Crystallographic News.—R. Sharizer[1] has studied the physical properties of *monazite* from a pegmatitic granite-vein near Schültenhofen, in the Böhmerwald. He finds it to crystallize in the monoclinic system, with an axial ratio 0.9735 : 1 : 0.9254. The inclination of the $\grave{a}$ to the $\acute{c}$ axis is 103° 37′. The plane of the optical axes is perpendicular to the clinopinacoid, and the acute bisectrix, which is positive, is in the obtuse angle β, and is inclined 5° 54′ to the vertical axis. The optical angle VV = 12° 44′ for yellow light, and the indices of refraction β = 1.9465 and γ = 1.9285.——In an article on hemimorphic pyrargyrite twins from Andreasberg, Schuster[2] discusses the classification of twinned crystals, and defines them as symmetrical or unsymmetrical. The symmetrical ones he subdivides into those hemitropically developed and those which show no hemitropism. The hemitropic symmetrical twins include those of holohedral and of certain hemihedral and hemimorphic minerals. The unsymmetrical and the non-hemitropic symmetrical classes embrace the twins of those minerals which crystallize in the inclined and trapezohedral-hemihedral divisions of the different systems, and also certain hemimorphic minerals. Examples are cited to show the application of the terms of this classification to the description of complicated twins.——As the result of new investigations with the Bertrand[3] microscope and lenses, Des Cloizeaux[4] finds that the mineral which bears his name crystallizes in the orthorhombic system.——Cathrein[5] describes crystals of orthoclase in the pores of granite at Predazzo, which have their largest development in the direction of their $\grave{a}$ axis.——The same author mentions twinning striations parallel to the octahedral edges of magnetite from Fürtschlagl, in the Zillerthal.

Miscellaneous.—J. Lehmann[6] explains the perthitic structure of certain of the feldspars by supposing that one of the minerals, as albite in perthite, is secondary, and fills cracks in the other. The cracks he further supposes to be occasioned by contraction in the original mineral, in consequence of sudden cooling, etc. He shows, by experimenting on a large number of different minerals, that this cracking takes place, under certain conditions, not in the direction of the cleavage, but in some other direction,—usually at right angles to the most perfect of all the cleavages. In the case of orthoclase, in which the cleavages are parallel to $\infty P\bar{\infty}$ and oP, the cracking takes place parallel to $\infty P\infty$. After formation in this manner the cracks are enlarged by the action of solvents and the secondary substance is deposited in them. ——The indices of refraction for topaz from the Urals, anglesite from Monte Poni, in Italy, sphalerite from Spain, and harstigite

[1] Zeits. f. Kryst., xii. p. 253. [2] Ib., p. 117.
[3] Bull. d. l. Soc. Min. de France, 1885, pp. 29, 377, and 426.
[4] Zeits. f. Kryst., xii. p. 178. [5] Ib., xii. p. 34. [6] Ib., xi. p. 608.

from Pajsberg have been recalculated by Ramsay,[1] from data furnished by the method in which prisms with large refractive angles are used. The method consists essentially in determining the refractive index of a mineral prism enclosed in a highly-refractive medium.——A few years ago Pfaff found that certain regular and uniaxial minerals possessed interfacial angles, which differed from their calculated values by some few minutes. He ascribed this irregularity to the tension producing optical anomalies, but did not show that the crystals measured were optically anomalous. Brauns[2] has measured isotropic and doubly-refracting lead-nitrate, spinel, and ammonium-alum. He compares the deviations from the true values of the interfacial angles of the isotropic varieties with the deviations noted in the cases of the doubly-refracting varieties, and arrives at the conclusion that a difference between the angles of singly- and doubly-refracting regular crystals does not exist.

[1] Zeits. f. Kryst., xii. p. 209. [2] Neues Jahrb. f. Min., 1887, i. p. 138.

Aug. 10, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, SEPTEMBER, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In the continuation[2] of his work on the rocks collected by the "Challenger" expedition, Renard has reached the discussion of the geology of the islands in the Indian Ocean. Those situated in the meridional part of the ocean are divided into five groups, three of which have been examined in detail. They are all of volcanic origin, and are in no way connected with Madagascar or the land within the Antarctic circle. The island *Marion*[3] is formed of volcanic rocks of two distinct ages, readily distinguishable by differences in the character of the vegetation they support. They both consist of feldspathic basalts, with anorthite as the plagioclastic constituent. The rocks of the island *Heard* are very similar to those of *Marion*. In the neighborhood of Corinthian Bay the prevailing rock is a feldspathic basalt, in which Baveno twins of bytownite are crowded together in groups. Many of these are optically anomalous in their action between crossed nicols, a fact supposed by Renard to be due to their fine lamellation. The olivine shows cleavages parallel to oP and a pinacoid. In some cases it has suffered alteration into pilite. In addition to the basalts a few specimens of limburgite were also collected.——The same author has recently studied the rocks of Kerquellen Land,[4] which had already been examined to some extent by J. Roth.[5] Renard finds that these rocks consist principally of basalts, with amygdules of analcite and zeolites. The grains of olivine in them are grouped together like the chondra of meteoric stones. In addition to the basalts there occur on the island trachites, limburgite, and phonolites. Of these the trachytes and phonolites are older than the basalts.——Two late articles on the petrography of the Tyrol add several interesting facts to our knowledge of this re-

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] American Naturalist, Notes, 1886, p. 640.
[3] Bull. d. l. Soc. Roy. de Belg., 1886, iii. p. 245.
[4] Bul. du Mus. Roy. d'Hist. Nat. de Belg., iv. p. 223.
[5] Monatsb. d. Kön. Akad. Berlin, 1875, p. 723.

gion. Baron von Foullon[1] separates the porphyrites of the Tyrol into quartz-porphyrites, quartz-mica-porphyrites, and diabase-porphyrites. In connection with the first group, Von Foullon records the replacement of hornblende by augite near the contact of the quartz-porphyrite and granite. The second group is characterized by the presence of garnet and an epidote, with the unusual pleochroism wine-yellow and violet. Intergrowths of this mineral and hornblende take place in such a manner that the axes b̄ and c′ of the former are parallel with c′ and b̄ of the latter. The hornblende in the rock often shows a parting parallel to oP. ——In the *Neues Jahrbuch* Cathrein[2] describes six rocks from various localities in the Alps. A staurolite-mica-schist occurs at Oberinnthal. It contains numerous hemimorphic crystals of tourmaline. A garnet amphibolite is remarkable for the occurrence in it of plagioclase pseudomorphs of garnet. The interior of the garnets are changed into plagioclase, around which is an exterior zone of compact hornblende. The serpentine of this region is an altered pyroxene rock. The remains of bronzite, enstatite, and diallage can still be detected in it. The most instructive portion of the paper is that devoted to the porphyrites and pitchstone-porphyries. Of the former several varieties are recognized. The first contains epidotized plagioclase and crystals of compact hornblende. In the second, in which uralite and a little augite occur instead of hornblende, the plagioclase is sausuritized. A third variety contains brown garnets in oscillatory combinations of the dodecahedron and the icositetrahedron. They are the oldest constituent. Of the pitchstone-porphyry the author says, this rock occurs in large independent masses, breaking through the prevailing quartz-porphyry in large dikes and bosses, no transition between the two being anywhere discernible.——A schistose rock from the Grossarlthal in the Alps contains chloritoid instead of mica as its bisilicate constituent. Cathrein[3] calls it a chloritoid schist. It contains nearly five per cent. of rutile and sphene.——The rocks of the Hereroland in Southwest Africa belong principally to the class of the older eruptives.[4] The quartz grains of some of the granites contain fluid inclusions with hexahedral crystals, and are pierced through by little needles of sillimanite. The most interesting observations are those on the crystalline schists. The gneiss is remarkable for the unusual association and decomposition of its constituents. The biotite is intergrown with sillimanite, and contains zircon crystals surrounded by pleochroic "*höfe*." Orthoclase and microcline are intergrown in the manner described by Becke.[5] The former has

[1] Jahrb. d. k. k. geol. Reichsaust, 1886, p. 747.
[2] Neues Jahrb. f. Min., etc., 1887, i. p. 147.
[3] Min. u. Petrog. Mitth., viii., 1887, p. 331.
[4] H. Wulf, Min. u. Petrog. Mitth., viii., 1887, p. 193.
[5] *Cf.* Min. u. Petrog. Mitth., iv., Taf. ii. Fig. 8.

undergone alteration into pseudophite, yielding a product having very much the appearance of serpentinized olivine. The augite gneisses are divided into scapolite-bearing varieties and those that contain wallastonite. The cleavage in the scapolite, as observed by Wulf, is parallel to ∞P, and is not parallel to $\infty P\infty$, as given in the text-books. The latter is probably a parting. The composition of the augite in both varieties approaches that of diopside. Other rocks described by Wulf are diorites, basalts, amphibolites, diorite-schists, mica-schists, etc.——Lacroix describes a gabbro from St. Clement in the Puy-de-Dôme, which contains, in addition to the usual constituents, the minerals vesuvianite, sphene, and wallastonite. The feldspar is anorthite with only 0.53 per cent. of Na_2O. It presents the appearance of having been crushed and recemented, the cementing material possessing the same optical orientation as the pieces it surrounds.

Mineralogical News.—Within the past few months the properties of quite a number of rare minerals have been investigated by mineralogists in this country and in Europe, with the results indicated below. W. C. Brögger[1] describes in detail the characteristics of *låvenite* and *cappelinite*. The former occurs on the island Låven in Langesundsfjord, and is also found in the eleolite syenite[2] of the Province of Rio Janeiro, Brazil. It forms brown to yellow, slightly transparent crystals, with a prismatic habit and vitreous lustre. It is monoclinic in crystallization with $\mathfrak{a} : \mathfrak{b} : \mathfrak{c}' = 1.0811 : 1 : 0.8133$, $\beta = 71° \; 24\frac{1}{2}'$. The twinning and the cleavage planes are parallel to the orthopinacoid, while the plane of the optical axes is the clinopinacoid. The mineral is strongly pleochroic, $\mathfrak{c} > \mathfrak{b} > \mathfrak{a}$ = red-brown, yellowish-green, and wine-yellow. Its specific gravity is 3.51, and its composition:

SiO_2	ZrO_2	Fe_2O_3 (?)	MnO	CaO	Na_2O	Loss at red heat
33.71	31.65	5.64	5.06	11.00	11.32	1.03

Cappelinite is found in a small vein in the augite syenite of Little Arö in Langesundsfjord. It occurs in thick brown hexagonal prismatic crystals with a fatty lustre. Their axial ration is 1 : 0.4301. Their analysis yielded:

SiO_2	B_2O_3	Y_2O_3	$La(Di)_2O_3$	Ce_2O_3	ThO_2	BaO	CaO	Na_2O	K_2O	H_2O
14.16	17.13	52.55	2.97	1.23	0.79	8.15	0.61	0.39	0.21	1.81

Warwickite, the borotitanate of magnesium and iron, occurring at Edenville, N. Y., is generally found in prismatic crystals elongated in the direction of the vertical axis, with a cleavage parallel to the clinopinacoid. Lacroix[3] has succeeded in obtaining measurements of these, which indicate a symmetry corresponding to that of the rhombic system. In accordance with

[1] Zeitsch. f. Kryst., x., 1885, p. 503, and Geol. För. i. Stockh. Förh., Bd. vii. p. 598.

[2] Fr. Graeff, N. J. B., 1887, i. p. 201. [3] Bul. d. l. Soc. Fr. du Min., ix. p. 74.

this view the plane of their optical axes is the orthopinacoid. Their bisectrix is positive and perpendicular to $\infty P\bar{\infty}$. $2E = 125°$. The mineral is pleochroic in red and brown tints. *Withamite* from the porphyrites of Glencoe, County Argyle, Scotland, the same author regards[1] simply as epidote. He also thinks[2] that *mismondine*, *sasonite*, *ottrelite*, *venasquite*, and *phyllite* are merely varieties of chloritoid, the optical properties of which he describes at length. *Xantholite* he supposed[3] to be identical with staurolite.——J. Strüver[4] does not consider *gastaldite* as a variety of glaucophane, but regards both minerals as distinct members of the amphibole group.——According to Lacroix[5] the *kirwanite* (of Thomson) is a mixture of amphibole, secondary quartz, and epidote. The same author[6] finds that *hullite* from Belfast is not homogeneous, and therefore should not be regarded as a definite mineral species. He states also that Dufrenoy's *dréelite* is an impure barite.——New analyses of *agalmatolite*[7] indicate that most of the substance to which this name has been given really possesses no definite composition, but is probably a mixture of silica and hydrated silicates of potassium and aluminium, resulting from the decomposition of orthoclase.——An apparently regular mineral has been found by Vom Rath[8] in the druses of an andesite near the apex of Cerro S. Cristobal near Pachuca, Mexico. It occurs in small octahedra, sometimes twinned according to the spinel law. It is often intergrown with tridymite. Hardness = 6–7. Specific gravity = 2.27. Its composition is $SiO_2 = 91$ per cent. $Fe_2O_3.Al_2O_3 = 6.2$ per cent. Both Vom Rath and Bauer regard it as most probably regularly crystallizing silica. It has been called *christobalite* to distinguish it from quartz, tridymite, vestan (Jensch, *Pog. Ann.*, 1858, p. 320), and asmanite.——A new variety of dufrenite has been observed by Messrs. Kinch, Butler,[9] and Miers in Cornwall, England. When fresh it is found in small black or apple-green orthorhombic plates, which in the thin section appear yellow or brown. Its hardness is 4.5 and specific gravity 3.233. An analysis yielded:

H_2O	CuO	P_2O_5	Fe_2O_3	CaO
10.68	0.96	30.42	55.93	1.51

The composition of the mineral corresponds with that of Streng's *kraurite*.[10]——The composition of a micaceous mineral from a limestone in the Kaiserstuhl is recorded by Knop[11] as follows:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	MgO	K_2O	H_2O
35.91	1.15	15.18	10.85	0.89	22.80	2.90	10.77

[1] Bul. d. l. Soc. Fr. du Min., ix. p. 75.
[2] Ib., p. 76. [3] Ib., p. 78.
[4] Neues Jahrb. f. Min., etc., 1887, i. p. 217.
[5] Bul. d. l. Soc. Min. d. Fr., viii., 1885, p. 428. [6] Ib., p. 435.
[7] Min. Mag., July. 1886, pp. 24 and 29; Dec. 1886, p. 74.
[8] Neues Jahrb. f. Min., etc., 1887, i. p. 198.
[9] Min. Mag., Dec. 1886, p. 65.
[10] Neues Jahrb. f. Min., 1881, i. p. 101. [11] Zeits. f. Kryst., xii. p. 607.

This mineral differs from biotite in the possession of water and a smaller percentage of potassium. As Hoppe-Seyler[1] found that when biotite is subjected to the action of carbon dioxide and water it loses potassium and gains water, Knop thinks that this mineral, which he calls *pseudobiotite*, may have been formed in the same way, especially as it is found most abundantly near the contact of limestone with phonolite. Knop further discusses[2] the constitution of biotite, but reaches no conclusions further than that the atomic relations of its constituents are $SiO_2 : R_2O_3 : Ro = 2 : 1 : 1.5$, corresponding to the formula $R_4''R_2'''Si_3O_{13}$.——Professor A. H. Chester[3] has recently communicated some notes on the chemical composition of a few obscure American minerals. *Fuchsite* from Aird Island, in Lake Huron, occurs in small layers and masses in a crystallized dolomite. According to Professor Chester's analysis it contains:

SiO_2	Al_2O_3	Cr_2O_3	Fe_2O_3	CaO	MgO	K_2O	Na_2O	H_2O
45.49	31.08	3.09	trace	0.51	3.36	9.76	0.90	5.85

A pink celestite from Landsville, Oneida County, N. Y., yielded results corresponding to a mixture of 84 per cent. $SrSo_4$, 11 per cent. $BaSo_4$, and 5 per cent. $CaSo_4$. The mineral has been called *baryto-celestite*, but Professor Chester considers it more probably an isomorphous mixture of the three carbonates. In addition to the analyses given above, there are in the paper quite a number of new analyses reported, the most interesting being those of *okenite*, *scorodite*, *brochantite*, and *zinkenite*.——Igelström[4] reports the existence of a manganiferous *vesuvianite* with 4.72 per cent. of MnO.

Crystallographic News.—Chas. O. Trechman[5] describes crystals of barite from Addiewell in Midlothian, England. They are found in small brilliant crystals covering rhombohedra of pearl spar and the dull faces of an older genera of barite. The new forms detected upon them are $7P\breve{\infty}$, $\frac{3}{8}P\bar{\infty}$, $P\frac{2}{3}$, $\frac{3}{4}P\frac{3}{2}$, $\frac{2}{3}P\bar{2}$, and $\frac{1}{5}P\frac{11}{5}$, $\breve{a} : \bar{b} : c' = .8152 : 1 : 1.3136$.——The examination by Hussak[6] of fluorite crystals from various localities, with reference to the question of optical anomalies, has revealed nothing definite in regard to the anomalous action in this case. He finds, however, that the structure of the mineral corresponds to the orthorhombic symmetry, with the axis of least elasticity normal to one of the cubic faces.——Mr. H. A. Miers[7] mentions orthoclase twins from the augite andesite of Kilimanjaro, in which the composition face (as well as the twinning plane) is the orthopinacoid. The crystals are bounded by the planes ∞P, $2P\bar{\infty}$, $\infty P\breve{\infty}$, and $0P$.

[1] Zeits. d. deuts. Geol. Ges., 1875, p. 515.
[2] Zeits. f. Kryst., xii. p. 588.
[3] Amer. Jour. Sci., April, 1887, p. 284.
[4] Bul. d. l. Soc. Fr. d. Min., ix. p. 22.
[5] Min. Mag., Dec. 1886, p. 49.
[6] Zeits. f. Kryst., xii. p. 552.
[7] Min. Mag., July, 1886, p. 10.

Miscellaneous.—Fremy[1] has succeeded in obtaining small well-colored crystals of ruby by subjecting to a red heat a mixture of alumina and minium, and also by heating to a high temperature equal weights of alumina and barium fluoride. In both cases the color was produced by the addition of small quantities of potassium bi-chromate.——Measurable crystals of quartz have been produced[2] by heating an enclosed dialysed solution of silica to a temperature of 320°. The crystals, ½ mm. in length, possessed the forms R, —R, ∞R, and in two cases $+\frac{2P_2}{4}$. Tridymite was obtained by fusing pieces of very acid rocks with the powder of basalts and melaphyres.——A concretion of coarse tourmaline pegmatite in the tourmaline granite near Pisek, Bohemia, contains pseudomorphs[3] of pyrite after tourmaline.——The rare mineral langite has been found by Von Foullon[4] forming the cement of a breccia in Pockwerke, Garnstein.

[1] Comptes Rendus, civ., 1887, p. 737.
[2] Chrustchoff, Neues Jahrb. f. Min., etc., 1887, i. p. 205.
[3] E. Döll, Verh. k. k. geol. Reichs., 14, p. 350.
[4] Ib., 1886, p. 464

Sept. 24, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, NOVEMBER, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

New Minerals.—*Langbanite* is the name applied by G. Flink[2] to a mineral which occurs in small black hexagonal crystals in a granular limestone at Långban, Sweden. In habit it is tabular or prismatic, with the prism faces but slightly developed. Its hardness is 6.5, specific gravity = 4.918. Its axial ratio is 1 : 1.6437. Its analysis yielded,—

Sb_2O_5	SiO_2	MnO	FeO
15.42	10.88	64.00	10.32

The discoverer regards it as silicate of manganese (Mn_5SiO_7) combined with antimonate of iron ($Fe_3Sb_2O_8$) in the proportions 37 : 10.——*Webskyite.*—This mineral, named by R. Brauns[3] after the late Professor Websky, of Berlin, is a decomposition product of the serpentine occurring in the paleopikrite of Amelose, near Biedenkopf, in Nassau. It occurs in black amorphous masses, with a bluish-green streak. Its hardness is 3 and its specific gravity 1.771. It is apparently isotropic in thin sections, where it possesses a green color. Its composition is as follows:

SiO_2	$Al_2O_3.Fe_2O_3$	FeO	MgO	H_2O	Loss at 110°
34.91	9.60	3.13	21.62	9.84	21.20

This corresponds to the formula $H_6R_4Si_3O_{13} + 6H_2O$, in which R = Mg and Fe.——*Laubanite* is described by Traube[4] as a new zeolite from the druses of the basalt occurring near Lauban, in Silesia. Its color is milk-white. It possesses a short columnar habit and a hardness of 4.5–5. It is found only in small crystals, implanted on phillipsite and other associated minerals. These crystals under the microscope are seen to be composed of little bundles of fibres. Its composition approaches very near to that of laumontite, from which it differs only in its percentages of calcium and water of crystallization.

Laubanite.	Laumontite.	Phillipsite.
$Al_2(SiO_3)_3$	$Al_2(SiO_3)_3$	$3Al_2(SiO_3)_3$
$2Ca(SiO_3) + 6H_2O$	$Ca(SiO_3) + 4H_2O$	$2Ca(SiO_3)$
		$K_2(SiO_3) + 12H_2O$

Recent Investigations of American Minerals. *Mica.*—Prof. F. W. Clarke,[5] of the U. S. Geological Survey, has recently published an interesting paper in which the relations between three American iron-micas are discussed. The three micas in question are lepidomelane from Baltimore, Md., and from Litchfield, Me., and annite from Rockport. Their compositions may be represented by the formulas

$R'_6R''_4R'''_2Si_5O_{20}$ (Rockport); $R'_6R''_3R'''_4Si_5O_{22}$ (Baltimore); and $R'_6R''_2R'''_6Si_5O_{24}$ (Litchfield).

[1] Edited by DR. W. S. BAYLEY, Madison, Wisconsin.
[2] Zeitschrift für Krystallographie, xiii., 1887, p. 1.
[3] Neues Jahrb. f. Min., etc., Beil. Band., v., 1887, p. 318.
[4] Ib., ii. p. 64.
[5] Amer. Jour. Sci., xxxiv., Oct. 1887, p. 131.

The relations existing between them may be best shown by supposing two of the univalent groups (AlO) to replace one (R'''_2O_3). Assuming this, the formulas may be written:

$$R'_{14}R'''_2(SiO_4)_5 = \text{Rockport mica.}$$
$$R'_{12}(AlO)_2R'''_2(SiO_4)_5 = \text{Baltimore mica.}$$
$$R'_{10}(AlO)_4R'''_2(SiO_4)_5 = \text{Litchfield mica.}$$

In the same paper there are also given analyses of iron-micas from Auburn, Me., and Pike's Peak, Colorado, and one of a muscovite from Alexander County, N. C., containing 1.10 per cent. of TiO_2.——*Howlite.*—This mineral was first identified by Professor H. How,[1] of Windsor, Nova Scotia, who named it silico-borocalcite. Messrs. Penfield and Sperry,[2] having recently come into the possession of a comparatively pure specimen of the mineral, have re-examined it. They find it to be composed as follows:

SiO_2	B_2O_3	CaO	Na_2O	K_2O	H_2O
15.33	44.52	27.94	0.53	0.13	11.55

They regard it as a distinct species with the formula $H_5Ca_2B_5SiO_{14}$.——*Cassiterite.*—The tin-stone of Mexico is divided by Professor Genth[3] into two varieties, a red and a yellow variety. Both are supposed to have been formed by precipitation from solution. The red variety is found in very small crystals, with a hexagonal habit. Analysis shows it to consist of dioxide of tin, containing a little ferric oxide and occasionally small quantities of arsenic pentoxide. The yellow variety occurs principally in imitative forms. It contains very little ferric oxide, but considerable arsenic pentoxide, and always an admixture of zinc oxide. Crystals of cassiterite implanted on hematite (after the manner of rutile on hematite from St. Gothard), and pseudomorphs of the former after the latter mineral, as well as after magnetite, are described by Professor Genth as not very uncommon in the sands and ores from the state of Durango.——*Mimetite* has been found in small crystals at the Mina del Diablo, Durango, Mexico. More frequently, however, it occurs in pseudomorphic forms after an unknown mineral, supposed by Dr. Genth[4] to be anglesite, by Professor von Rath to be galena, and by Dr. Brezina to be mendipite.——*Vanadinite.*—This mineral occurs on quartz in the Mammoth Gold Mine, near Oracle, Pinal County, Arizona. It is sometimes coated with calcite, which is in turn coated with a second generation of vanadinite. Other localities for vanadinite are Yavapai County, Arizona; McGregor Mine, Grant County, New Mexico; and Bald Mountain Mine, Beaverhead County,

[1] Philos. Mag., iv. xxxv., p. 32. [2] Amer. Jour. Sci., Sept. 1887, p. 220.
[3] Contributions from the Chemical Laboratory of the University of Pennsylvania, xxix., 1887, p. 4.
[4] Ib., p. 10.

Montana.——*Descloizite* (*ramirite*), from San Luis Potosi, Mexico, yielded Professor Genth[1] on analysis the figures,—

PbO	CuO	ZnO	As_2O_5	V_2O_5	P_2O_5	Loss on ignition
54.52	6.58	12.70	3.63	19.99	0.13	2.62

a result not very different from that obtained by Penfield[2] in 1883.——*Tapalpite*, from the Sierra de Tapalpa, Jalisco, Mexico, is regarded by Rammelsberg as being represented by the formula $Ag_2S.Bi_2Te_2$. Professor Genth[3] has analyzed some comparatively pure material, with this result:

Ag	Pb	Bi	Cu	Te	S
38.59	7.24	25.05	0.21	17.43	8.24

which, after deducting the impurities, would give, as the composition of tapalpite,

Ag	Bi	Te	S
46.09	24.99	21.67	7.25

corresponding to a normal sulpho-telluro salt of silver and bismuth.——In the paper in which the above-mentioned minerals are discussed, Professor Genth describes *pyrite* pseudomorphs after *pyrrhotite*, from Colusa County, Cal.; *hessite*, from Tombstone, Arizona; *allanite*, from Statesville, N. C.; *willemite*, from Socorro County, New Mexico; and *hisingerite* pseudomorphs after *calcite*, from Ducktown, Tenn.——*Bismutho-sphærite.*—This mineral has for some time been regarded as a basic carbonate of bismuth, but its composition has not until very recently been determined by means of analysis. A short time ago Mr. H. L. Wells[4] obtained large specimens of the mineral from Willemantic and Portland, Conn. The Willemantic occurrence is described as a dark-gray mineral, holding in its centre a nucleus of bismuthinite. Its specific gravity is 7.42. Under the microscope it was seen to consist of a dark ground-mass, in which patches of a pale yellowish-green color are scattered. The dark portion is almost opaque from the numerous black dust-like inclusions it contains. These are supposed to represent traces of the original mineral from which the bismutho-spharite was derived. An analysis yielded,—

Bi_2O_3	SO_3	Silicates	CO_2	H_2O
91.64	0.34	0.08	8.03	0.47

corresponding to the formula $Bi_2O_3.CO_2 = (BiO)_2CO_3$.——*Crocidolite.*—Messrs. Chester and Cairns[5] have recently published an analysis of the bluish-gray fibrous crocidolite from Beacon Pole Hill, near Cumberland, Rhode Island, with the result (as the mean of two analyses):

SiO_2	Fe_2O_3	FeO	MgO	Na_2O	H_2O
51 58	16.90	21.22	0.15	6.34	3.79

[1] Ib., p. 15.
[2] Amer. Jour. Sci., xxvi. p. 361.
[3] L. c., p. 18.
[4] Amer. Jour. Sci., October, 1887, p. 271.
[5] Ib , xxxiv., 1887, p. 108.

This composition is represented by the authors by the formula $Fe_3Na_2H_4Fe_2(Si_9O_3)_9 = 3FeO.Na_2O.2H_2O.Fe_2O_3.9SiO_2$, in which the water is regarded as basic. The authors cannot accept the prevalent view that crocidolite is merely a fibrous arfvedsonite. ——*Datholite.*—Mr. Whitfield[1] has analyzed the datholite from Bergen Hill, N. J., determining the boric acid by the Gooch[2] method. His figures are:

SiO_2	FeO	CaO	B_2O_3	H_2O
35.74	0.31	35.14	22.60	6.14

corresponding to the formula $B_2O_3.H_2O.2CaO.2SiO_2 = H.CaSiO_3.BO_2$, the generally accepted formula for this mineral.——*Ulexite.*—Ulexite, from Rhodes Marsh, Esmeralda County, Nevada, yielded the same analyst[3] the following figures:

SiO_2	Cl	B_2O_3	SO_3	CaO	Na_2O	K_2O	H_2O
0.04	2.38	43.20	0.28	14.52	10.20	0.44	29.46

These figures are represented by the formula $NaCaB_5O_9 + 6H_2O$, after making certain allowances for impurities.——*Siderite* (*sphærosiderite*).—This mineral[4] occurs at Baltimore, Md., associated with zeolites in the gneiss of the Jones Falls quarries. The crystals are small and lenticular in shape. They possess only the forms R and oR, except in one instance, where the negative scalenohedron $-\frac{1}{4}R^4$ is supposed to occur. In these crystals the faces are generally rounded, forming a lens-shaped body. Frequently two of these lenses are grouped together so as to form apparent twins. And further, many lenses grouped together produce a perfect sphere. Analyses of selected material by Mr. A. G. Palmer gave,—

FeO	MgO	MnO	ZnO	CO_2
59.63	1.05	0.91	1.72	37.93

It is thought that the presence of manganese and zinc may have had some influence in the production of these rounded forms, not uncommon in the pure manganese carbonate-rhodochrosite. ——*Samarskite.*—Samarskite[5] is found in the coarse-grained granitic veins cutting the schists in which the zeolites (referred to above) occur. It is described by Professor König as a very splintery, black mineral with a hardness of about 6–7. Its specific gravity is 6.146. An analysis yielded,—

Metallic acids	UO_2	Y, Er, etc.	(CeTh)O	FeO
56.40	13.48	11.90	3.85	8.98
Fe_2O_3		Al_2O_3	Ignition	
1.66		2.00	0.30	

[1] Ib., October, 1887, p. 281.
[2] Amer. Chem. Jour., ix., 1887, p. 23, and ii., 1880, p. 247. [3] L. c.
[4] Notes on the Minerals occurring in the Neighborhood of Baltimore, by G. H. Williams, Ph.D., Baltimore, 1887, p. 12.
[5] Ib., p. 16.

The specific gravity of the metallic acids (5.769) is too high for niobic acid, while no tantalic acid was detectable by Rose's method,—facts which Professor König does not understand.——*Beaumontite.*—Several crystals of this mineral have recently been measured by Messrs. Burton and Gill,[1] who find no reason to suppose that it is not crystallographically identical with heulandite, as Des Cloizeaux found it to be in its optical properties.——*Rutile.*—The rutile crystals occurring in the spodumene-bearing pockets of the gneiss in Sharp's township, Alexander County, N. C., are described by Messrs. Hidden and Washington[2] as small, with the rare basal pinacoid prominent and well polished. Measurements of these crystals resulted in the detection of the new forms $\frac{3}{7}P$, $\frac{1}{2}P$, $\frac{2}{3}P$, 4P, and $P_{\bar{8}}$. A recalculation of the axial relations gave 1 : 0.64425.——*Apatite.*—A small crystal of apatite implanted on muscovite, from the same locality as that mentioned for rutile, is described by the same writers as almost unique in habit, the prisms $\frac{1}{2}P$, P, and 2P2 predominating. From data obtained in the measurement of this crystal, a recalculation of the axial relations for apatite gives this as 1 : 0.7343. A cruciform twin of apatite is described and figured, in which the twinning plane is 2P2. This is interesting as the first description of a twin of this species.——*Beryl.*—Two new planes have been discovered by the same authors on the emerald beryls of the Alexander County locality. These planes are $\frac{1}{12}P$ and $\frac{15}{7}P\frac{15}{8}$. On all the beryl from this locality it was observed that the prism face ∞P is perfectly smooth, while ∞P2 is covered with little triangular pits.——*Quartz.*—Some time ago Vom Rath[3] noted the occurrence of the plane $\infty P\frac{4}{3}$ on the alternate prismatic edges of certain quartz-crystals from Alexander County, N. C. Messrs. Hidden and Washington[4] find this same form holohedrally developed in each consecutive prismatic edge.——*Topaz.*—A clear crystal of topaz[4] from Zacatecas, Mexico, contains the new plane 7P∞.——*Pyroxene.*—Certain crystals of pyroxene from Orange County, N. Y., possess[5] a tubular habit due to the development of the basal plane, and are remarkable besides in that they are hemimorphic in the direction of the vertical axis. The upper portions of the crystals show the forms oP, —P, P, 2P, ∞P, $\infty P\grave{\infty}$, and $\infty P\bar{\infty}$. Moreover, the lower planes are so developed that these portions of the crystals must be regarded as twinned, while the upper portions are simple individuals.——*Scorodite.*—In a late number of the *American Journal of Science*, Mr. Hague[6] discusses the deposition of scorodite from the arsenical waters of the Yellowstone National Park. The mineral occurs as a green coating covering the siliceous sinter de-

[1] Ib., p. 10.
[2] Amer. Jour. Sci., xxxiii., 1887, p. 501.
[3] Zeits. f. Krystal., xii., p. 456.
[4] L. c.
[5] G. H. Williams, Amer. Jour. Sci., Oct. 1887, p. 275.
[6] September, 1887, p. 171.

posited by the Joseph's Coat Springs and other geysers, and is also often found in little nodules in the cavities of this sinter. An analysis of the purified scorodite yielded Mr. Whitfield,—

Fe_2O_3	As_2O_5	H_2O
34.94	48.79	16.27

Analyses of the waters of these geysers show a small percentage of arsenious acid.——Reusch[1] has examined the crystallized *kaolin* from Denver, Colorado, to which Cross and Hillebrand first called attention.[2] He declares it to be triclinic and not orthorhombic as Hillebrand supposed.——A. Kenngott[3] describes two peculiar crystals of *gypsum* from Poland, Ohio, and calls attention to a new formula for *tantalite* from Dakota, based upon the analysis of Schaeffer,[4] published a few years ago.

[1] Neues Jahrb. f. Min., etc., 1887, ii., p. 70. [2] Bull. U. S. G. S., No. 20.
[3] Ib., 1887, ii., p. 84. [4] Amer. Jour. Sci., 1884, xxviii., p. 430.

Dec. 10, 1887.

(EXTRACTED FROM THE AMERICAN NATURALIST, DECEMBER, 1887.)

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—In an exceedingly interesting paper recently published, Dr. A. Lagorio[2] discusses some of the fundamental principles relating to the nature of the glassy base of porphyritic rocks, the succession of crystallization in rock-magmas, and the classification of rocks. He emphasizes the thought that the geologist must ask the aid of chemistry and physics in solving the problems which present themselves to him. He must obtain all the light that these kindred sciences can lend him, and in this light must approach the hidden mysteries locked up in the depths of rock-masses, and must examine them with the critical eyes not merely of the geologist, but of the chemist and physicist as well. We may then, he thinks,

[1] Edited by DR. W. S. BAYLEY, Madison, Wisconsin.
[2] Miner. u. Petrog. Mitth., viii., 1887, p. 422.

obtain some knowledge as to the origin of rocks, their relations to each other, and the causes of the great variation in structure observed in them. The paper is full of interesting facts and valuable suggestions. It begins with a discussion of the theory proposed by Rosenbusch to account for the successive crystallization of rock-constituents. It has been recognized for a long time that the minerals in a rock did not crystallize in the inverse order of their fusibility, as might at first thought be expected. The order in which the separation takes place bears no relation to the temperature of solidification. Rosenbusch regards the acidity of the minerals as the important element governing their crystallization. He states, as a general law, that the order of the separation of the minerals from a rock-magma is inversely as their acidity. Roth[1] has called attention to the very many exceptions to this rule, and in its place gives seven empirical laws of association. Lagorio refuses to accept Rosenbusch's law, and proceeds to investigate the subject by chemical methods. He analyses the glassy ground-mass and crystallized portions (Ausscheidungen) of artificial and natural glasses, and thoroughly discusses the figures thus obtained. He finds that the *sodium-silicates* possess a stronger tendency to crystallize from a molten magma than do the corresponding isomorphous potassium compounds. Sodium is concentrated in the crystallized portions, and potassium in the residual ground-mass. With this discovery as his governing principle, Lagorio examined rocks varying widely in their composition and structure. Upon discussing the figures which these analyses yield, the following conclusions are reached: (1) A rock-magma is a more or less completely saturated solution of different silicates. (2) The normal glass—that in which all the other silicates are dissolved, or, more precisely, the last substance to crystallize from a molten rock or glass-magma—is a silicate of the composition $K_2O.2SiO_2$. This compound is capable of holding in solution silica, magnesia, lime, alumina, and iron-oxides, and from this solution the minerals separate out in a certain order, which is determined by the different amounts of the elements in solution and their affinity for each other, the sodium-bearing minerals always crystallizing before the corresponding potassium-bearing compounds. (3) The order of solubility of various compounds in the normal glass is: potassium compounds; sodium-silicates; calcium-, magnesium-, iron-salts; and, finally, oxides of the heavy metals, the latter being the most soluble. The greatest amount of supersaturation obtains in the case of the most soluble compounds. From such a supersaturated solution—a rock-magma—minerals separate in the order of the excess of saturation,—viz., the oxides of the heavy metals first, then the silicates of the heavy metals, then sodium-silicates, and, finally, quartz and the potassium-

[1] J. Roth, Chem. Geologie, ii. pp. 49 and 69.

silicates. (4) The stronger tendency of sodium compounds to separate, as compared with potassium compounds, is seen in the case of the sodium-bearing hornblendes and augites. (5) Sanidine crystallizes from a molten magma only after the relative proportions (molecular) of K_2O and Na_2O in it become as 2 : 1. (6) The affinity of the elements for each other is an important factor in determining the order of crystallization. Calcium and sodium are widely found associated in the same minerals, magnesium and sodium rarely. Potassium, on the other hand, occurs frequently with magnesium, rarely with calcium, etc. (7) The order of crystallization is as follows: Oxides, pure Fe-silicates, Mg-silicates, Fe + Mg-, Mg + Ca-, Mg + K-, Ca-, Ca + Na-, Na-, K-silicates, and, finally, silica, which latter, however, frequently separates out before or contemporaneously with the potassium-silicates. (8) The composition of a second generation of minerals in a porphyritic rock is dependent upon the composition of the residual magma at the time of their solidification, and not upon a recurrence of the conditions under which the corresponding minerals of the first generation were produced. (9) The more or less complete development of the constituents of the ground-mass of a rock is but slightly, if at all, dependent upon the rapidity with which the original magma cooled. In addition to these results obtained by a study of the composition of the different portions of a rock, Lagorio also discusses several theoretical questions of general interest. He believes that the hornblende and mica in rocks were formed in the presence of water[1] and under pressure. The existence of basic hydrogen in many members of the mica group, he thinks, would indicate this fact. He also criticises many of Rosenbusch's statements as to the origin of the plutonic rocks, which, Lagorio says, were originally eruptive or intrusive, but in their present condition are metamorphic. In conclusion, attention is called to the system of classification proposed by Rosenbusch[2] for the massive rocks, and some of the hypotheses upon which it is based are shown to have no foundation in fact. The paper, as a whole, is an admirable one, and bears evidence of care in its preparation. It is to be hoped that it will act as an incentive to more work in the direction of experimental and chemical geology.——In a late number of the *Quarterly Journal of the Geological Society* Mr. Rutley[3] has a paper on the rocks of the Malvern Hills, which, upon the occasion of its delivery before the society, gave rise to considerable debate. Mr. Rutley describes in detail the structure of the Malvern Hills, and gives two plates illustrating his views. The rocks of the range he divides into three classes,—eruptive, foliated, and stratified. The first consists principally of diorites, diabases, gabbros and granites, and felsites. These he describes

[1] *Cf.* American Naturalist, 1886, p. 160.
[2] Ib., February, 1887, p. 172.
[3] August, 1887, p. 481.

singly. The most notable fact in their consideration is the supposed occurrence of topaz in the felsite and the grouping of little crystals of this mineral in such a manner as to bring out the pearlitic structure of the rock. The second class the author "is inclined to regard . . . as probably being more or less altered volcanic tuffs, or as sedimentary rocks mainly composed of eruptive material derived from the disintegration of rocks of a dioritic or syenitic character." Various reasons are given for this conclusion, none of them, however, being based on petrographical evidence. The stratified rocks embrace tufas and quartzite.——Bergeron[1] mentions the occurrence of hyperite in the carboniferous of Aveyron, near the village of Arvieu. It contains intergrowths of hypersthene and diallage, in which $\infty P\bar{\infty}$ of the hypersthene is parallel to $\infty P\bar{\infty}$ of the diallage. The large crystals of hypersthene exhibit pressure effects to such a degree that the broken pieces of this mineral have been separated from each other, and between them have been injected portions of the granulitic ground-mass. The minerals comprising this ground-mass are round, and possess no crystal outlines. The smaller grains consist of pyroxene, which tends to group itself around the larger crystals of hypersthene, forming an aureole. The larger grains of the ground-mass are labradorite.——E. Cohen[2] has recently called attention to the fact that andalusite occurs much more frequently as an accessory mineral in normal granite than had formerly been supposed. He mentions five granites from the Vosges, Croatia, the Schwarzwald, and Vogesen, each of which contains more or less andalusite, but in quantity too small for isolation. In an aplitic tourmaline granite from Alt Zschillen, near Wechselburg, in Saxony, Cohen finds it in sufficient quantity for isolation, but not for analysis. The mineral occurs in isolated columnar and acicular forms, and not in groups, as in the case of contact rocks and the crystalline schists.

Mineralogical News.—After experimenting upon the effect of high temperatures on the optical properties of *faujasite* crystals, Rinne[3] concludes that this mineral is normally regular in crystallization. When exposed to the air it begins to lose water and becomes uniaxial, breaking up at the same time into eight individuals, each extending from an octahedral face into the centre of the crystal. These individuals are positively refractive, and their optical axes are perpendicular to the octahedral faces. When heated in contact with the air the difference between the index of refraction of the ordinary ray and that of the extraordinary ray becomes less and less as the temperature increases, until at 150° $\omega = \epsilon$. At this temperature the mineral loses 16.83

[1] Comptes Rendus, cv., 1887, p. 247.
[2] Neues Jahrb. f. Min., etc., 1887, ii. p. 178.
[3] Ib., i. p. 17.

per cent. of water,—equivalent to twelve molecules. Above 150° the mineral remains uniaxial, but refracts negatively. When thin sections of the mineral are allowed to cool in the air they revert to their original condition of positive refraction, but if cooled under balsam (protected from the air) they remain negatively refractive. Faujasite, therefore, passes from the regular system to a crystallographic system of a lower degree of symmetry upon loss of part of its water. *Heulandite* from Andreasberg, on the contrary, is monoclinic under ordinary conditions. When heated to 150° it loses two molecules of water and becomes orthorhombic. It regains its original condition if submitted to the action of the atmosphere. This peculiarity of the Andreasberg heulandite is supposed by Rinne to be due partly to the large amount of strontium it contains, and its consequent approach in composition to brewsterite, which is known to possess peculiarities similar to those described. Jannasch, who has examined the heulandite from Andreasberg,[1] finds that it does in reality contain a large amount of strontium. ——Sandberger[2] thinks that, whatever might be the origin of *graphite*, it can certainly not have been produced in any igneous way. In studying Ceylon specimens of this mineral, he has discovered pieces on the $\infty P\bar{\infty}$ faces of which are numerous little *rutile* crystals cutting each other at an angle of 60°, in the manner so frequently seen in mica. Had the temperature at the time of the formation of these crystals been high, he argues, they would have been reduced to the metallic state in the presence of such great excess of carbon. He also finds that many of the minerals associated with the graphite are covered with a coating of this mineral. Among the minerals thus covered may be mentioned quartz, orthoclase, mica, and apatite. Upon removing the outside shell of graphite from around the apatite, this mineral was seen to be marked with the outlines of the rutile needles imbedded in the graphite. This, says Sandberger, is an indication that the latter mineral was formed before the apatite had become hard.——In an article on the minerals of the Tyrol Cathrein[3] describes *grossularite* crystals, which, when broken open, are seen to consist of alternate zones of garnet and bluish calcite, of which the internal zones of garnet differ from the external zones both in color and composition. He examines also the so-called *paragonite* from Greiner (Zillerthal), and finds it to possess the ideal composition of talc. Cathrein also describes pseudomorphs of *fassaite* and *garnet* after gehlenite. The garnet pseudomorphs here described are the first known cases of the pseudomorphic origin of garnet. According to Klein and Jannasch,[4] the *ullmanite* (NiSbS) crystals from Löl-

[1] Neues Jahrb. f. Min., etc., 1887, ii. p. 39.
[2] Ib., p. 12.
[3] Miner. u. Petrog. Mitth., viii., 1887, p. 400.
[4] Neues Jahrb. f. Min., etc., 1887, ii. p. 169.

ling (Carinthia) and from Sarrabus (Sardinia) possess the same chemical composition. The mineral from Lölling, however, crystallizes in the inclined hemihedral division of the regular system, while the Sarrabus occurrence is parallel hemihedral. ——On *barite* crystals from the dolomite, near Volpersdorf, the four new planes $\infty\check{P}5$, $3\check{P}\infty$, $5\check{P}\infty$, and $\frac{1}{4}\check{P}2$ have been detected by Traube.[1]——Patton[2] studies crystallographically the *hornblende*, *oligoclase*, and *titanite* crystals in the druses of the Schriesheim diorite.——Igelström[3] describes the occurrence of braunite and hausmannite from the Sjögrube, in the Gouvernement of Oerebro, Sweden.——Ch. Lory[4] notes the occurrence of microscopic crystals of *albite* in various limestones and marbles from the Western Alps. Their origin, he thinks, is connected in some way with the specific nature of the calcareous deposits and with the conditions which produced their crystallization.

[1] Neues Jahrb. f. Min., etc., 1887, ii. p. 69.
[2] Ib., p. 261.
[3] Ib., p. 8.
[4] Comptes Rendus, cv., 1887, p. 99.

Jan. 30, 1888.